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Prehistoric Giant!

More Monstrous Than T. Rex?

Web Surfing for Sci-Tech

Radically Chic PC

Head to Head: Ford vs. Chevy Pickups

Cordless Tools: Bigger and Brawnier

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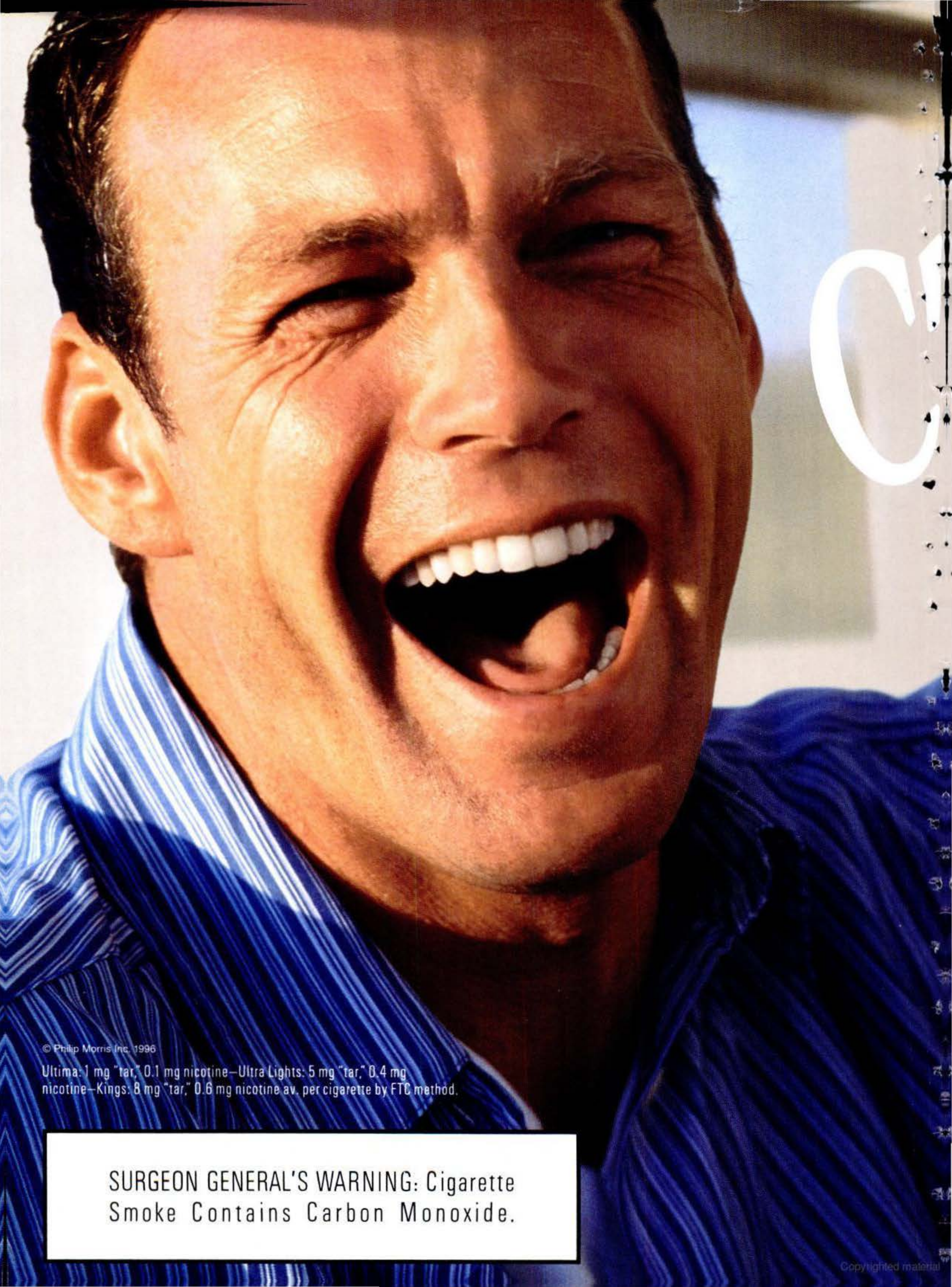

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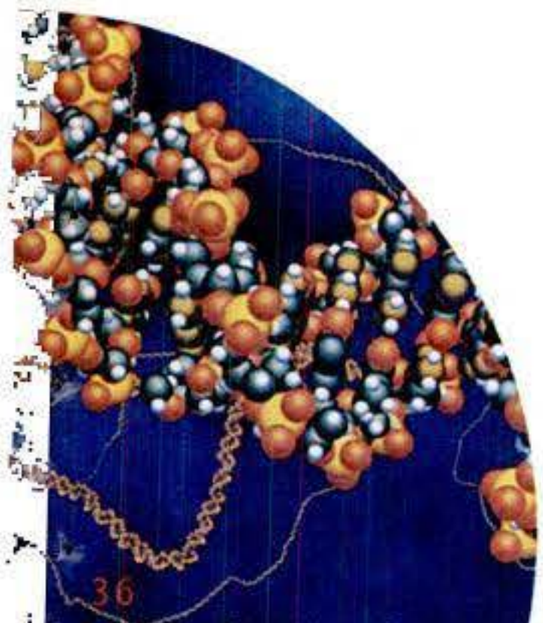

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Founded in 1872 Volume 249 Number 3

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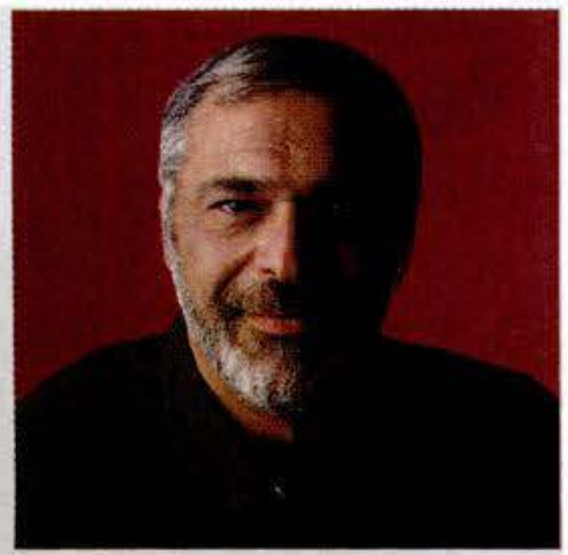
FROM THE EDITOR-IN-CHIEF



Dinosaur Hunting and Web Surfing

ALLOW US TO INTRODUCE YOU to *Carcharodontosaurus saharicus*—the "shark-toothed reptile of the Sahara." This giant, 90 million-year-old predator is the latest and most spectacular trophy of globe-trotting dinosaur hunter Paul Sereno. For our cover story this month, senior editor Mariette DiChristina profiles the man and his monster.

Want to keep tabs on NASA launches? How about dissecting a frog—virtually? Or searching the government's database of patents and trademarks? The World Wide Web puts hundreds of thousands of science and technology sites—from gadgets to interactive experiments—at your fingertips. In this issue, POPULAR SCIENCE Web surfers have compiled a master list of their favorites, and you can hotlink your way to more. Be sure to check our own Web site regularly—and our monthly Web Watch column—for new links.—*Fred Abatemarco*, **popscied@aol.com**

Multipurpose Fighters

IN YOUR ARTICLE, "The Next Jet Fighter" [June], you say the Joint Strike Fighter (JSF) is scheduled to replace the F-14, the F-18, the A-6, the F-16, and the AV-8B Harriers in the future. This sounds a lot like the Tactical Fighter Experimental (TFX) of the 1960s that produced the F-111 "Aardvark." The TFX program that was developed by Robert McNamara, Secretary of Defense at the time, didn't work in the '60s and, because of that, I doubt the JSF will work in the future. The Department of Defense shouldn't put all its eggs in one basket.

Bennett S. Turk
Latham, N.Y.

New Standards

A VERY SIMPLE answer exists to the question of setting standards for electronic equipment [Beyond Here, June]—let the professional engineering organizations do it. These organizations have no bias toward any one company or product and, therefore, the standard they set would not favor any one company. The one problem is that they generally take some time in order to develop an official standard, which is in direct opposition to the "breakneck pace" that many computer and electronic companies like to develop at.

Ken Davis
Scottsdale, Ariz.

Check This Out

AN ADVANTAGE of online checking that Chris O'Malley missed in "Wired to the Bank" [June] is that recurring payments that remain the same month after month (like loan payments) need only be set up once. Thereafter, the funds get issued on the same day of each month, with no intervention on the payer's part. Combined with direct payroll deposit from the payer's employer, the task of paying bills can been placed on auto-pilot.

Thomas Chadwick
Essex Junction, Vt.

Freezing Hot

YOU CORRECTLY answered the question "What freezes faster, cold or hot water?" [FYI, June], but my physics professor explained that the misconception about hot water freezing faster may have come from an old wives' tale from the time before frostless freezers. According to the theory, an ice cube tray filled

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with hot water would freeze faster than a tray of cold water because the hot water would melt the frost in the freezer, putting the tray closer to the freezing element.

Jerry A. Pipes
St. Louis, Mo.

Solar Systems

"POWER HOUSES" [May] presented an excellent overview of photovoltaic technology and described many exciting new photovoltaic products. However, the U.S. Department of Energy's pivotal role in launching the research and development of these technologies was not mentioned. A program initiated by the DOE in 1993 stimulated the development of the solar shingles and the custom roof panels on the Lord house in Maine.

Christine A. Ervin
Department of Energy
Washington, D.C.

Lead Remedy

IN "FUTURE Faucets Go Light on Lead" [Home Technology Newsfront, May], you mention that lead can leach out of faucets into the drinking water. It is the water that sits in the faucet between uses that has the most lead in it. To reduce the amount of lead in drinking water, let the water flow for a few seconds prior to use.

Mark Demos
via e-mail

Time Lapse

THE REFERENCE in "The Facts" to the change from the Julian to Gregorian calendar in 1582 is not complete [FYI, June]. Being a Protestant nation, England paid no heed to the Pope and did not change to the Gregorian calendar until 1752. At that time, King George II decreed that September 2 be followed by September 14 that year. The King also decreed that the start of the new year be changed from March 25 to January 1.

Bob Stillett
rsillett@msn.com

Motorcycle Memories

THE ARTICLE about the centrifugal oil filter from T&N Bearings Group, [Automotive Newsfront, April] reminded me of a similar arrangement on Honda motorcycles in the early 1970s. The centrifugal basket was mounted on the crankshaft and did a great job of filtering out the damaged particles. Oil changes were still recommended, but the drained oil rarely felt gritty.

misan45@aol.com

Yearning to Yawn

YOUR ANSWER to "Why is yawning so contagious?" [FYI, May] failed to mention that a lack of oxygen and an increase in carbon dioxide is a probable cause, in addition to the other reasons you cited.

Lyle Tuttle
ltuttle@primenet.com

Laboratory tests demonstrate that people yawn even when they breathe pure oxygen. Tests also show that when people breathe high levels of carbon dioxide, they are no more likely to yawn than usual.

Juxtaposed GPS

IN LETTERS [June], James Rivera says the Global Positioning System was funded and implemented by NASA. Not true. GPS was developed by the Department of Defense.

Derrick A. Dean

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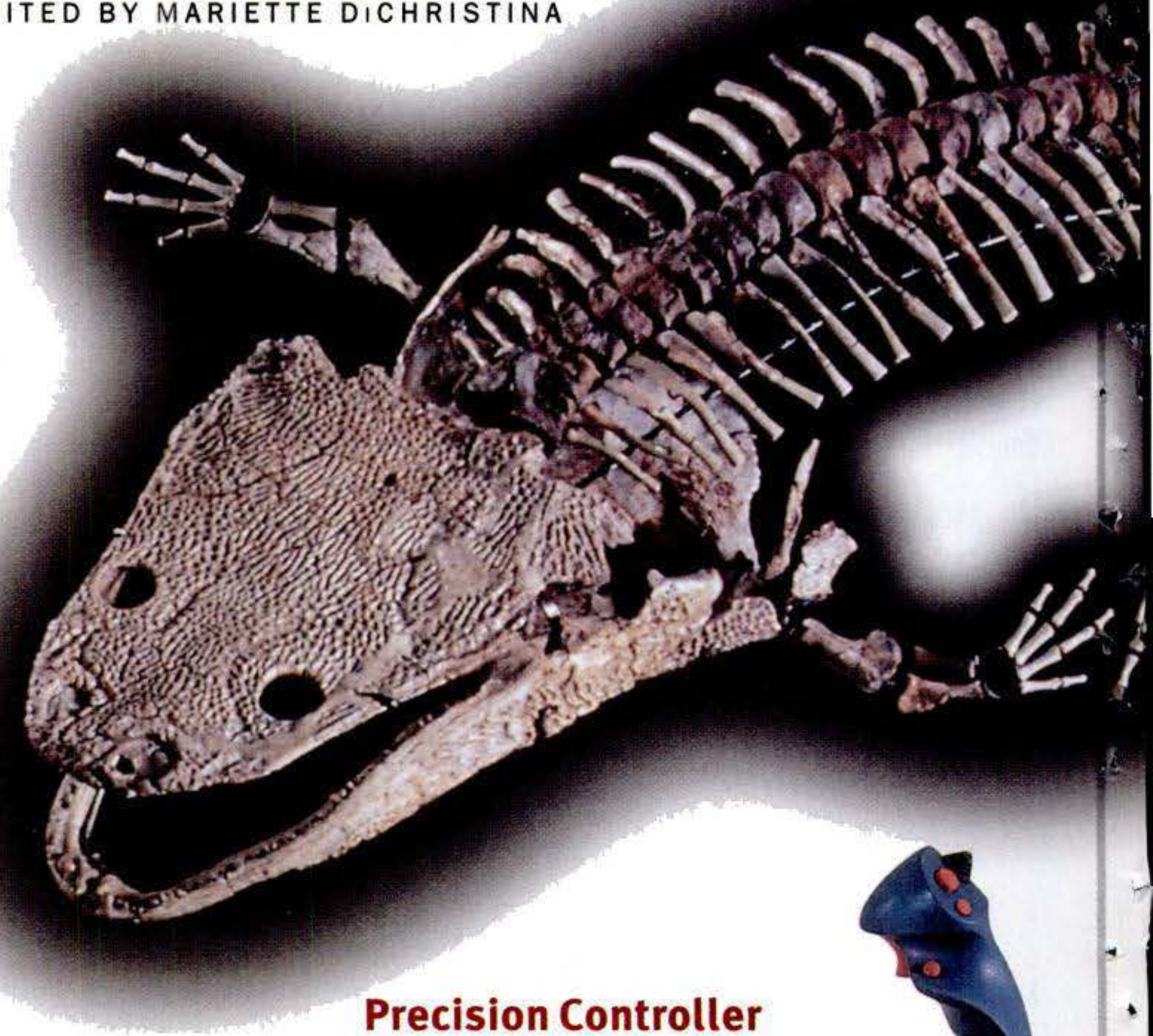

Beginnings of Backbones

WITH THE OPENING of the Hall of Vertebrate Origins at the American Museum of Natural History, a last, key piece of the story of evolution stands reconstructed. The exhibit is part of a massive, seven-year reinstallation of the museum's fossil halls. Some 85 percent of the display items, such as this *Buetteneria*, are real fossils, rather than reproductions—far more than at many such exhibits. Address: Central Park West at 79th St., New York NY 10024-5192.

Mega Mac

THIS IS NOT YOUR wimpy home computer. Apple's new Performa 6400 comes loaded with a 180- or 200MHz PowerPC 603e processor, a 1.6- or 2.4-gigabyte hard disk, 16MB of memory, and a built-in speaker system—including a subwoofer atop the tower-style case. The prices aren't wimpy, either, ranging from $2,499 to $2,799, without a monitor. One intriguing $450 option: A video editing kit called Avid Cinema lets you make movies from your camcorder tapes.

Precision Controller

FOR FAST-PACED 3D action-adventure games, the Wing Man Warrior double-fisted control system is designed to give you lightning-fast reflexes quickly. SpinControl (the knob on the left) lets you turn your character 360 degrees on a dime, while the Warrior joystick provides firepower and speed control. Price: $100. Logitech, 6505 Kaiser Dr., Fremont CA 94555.

Fresh-Air Mower

IN RESPONSE TO 1997 EPA emissions regulations, Lawn-Boy redesigned its two-cycle mower engines to run 50 percent cleaner. Three keys to success: a domed combustion chamber helps mix the air, so more of the fuel is burned; the air-to-fuel mix has been adjusted; and the muffler size has been increased to remove exhaust air more effectively.

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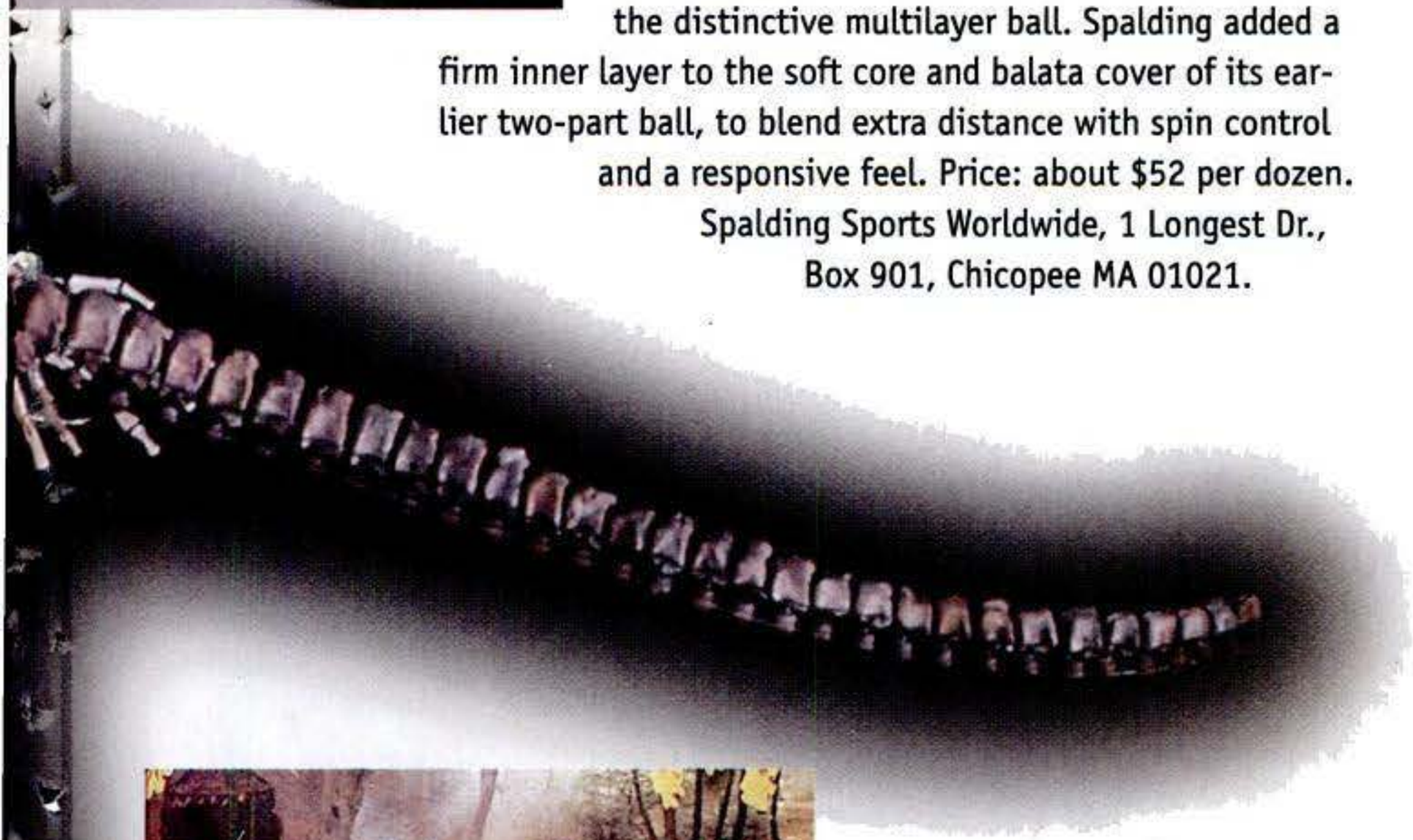
Strata-Sphere

SPALDING'S TOP-FLITE Strata Tour got a huge boost from golf pro Mark O'Meara, who racked up two firsts and two seconds in a few weeks with the distinctive multilayer ball. Spalding added a firm inner layer to the soft core and balata cover of its earlier two-part ball, to blend extra distance with spin control and a responsive feel. Price: about $52 per dozen. Spalding Sports Worldwide, 1 Longest Dr., Box 901, Chicopee MA 01021.



Modem Without Wires

IBM'S PROTOTYPE cordless modem uses the same basic radio-frequency technology as cordless phones to move data between a standard modem and a wall jack equipped with an included adapter. The 900MHz device is designed to work with any computer—laptop or desktop—and any modem. IBM plans to sell the product under its own name and license it to other companies as well. No price has been set yet; it's slated to be available later this year.

They Seek the Grail

MONTY PYTHON is back—returning for a second madcap performance on a 7th Level CD-ROM, that is. This time it's the decidedly nonlinear version of their movie classic, called Monty Python and the Quest for the Holy Grail. Scenes from the film are coupled with new artwork, voice-overs, and games based on the antics of the Python troupe. It's fun, irreverent, and lacking any redeeming social value. For Windows PCs, $50. 7th Level, 1110 E. Collins Blvd, #122, Richardson TX 75081.

Ghia's Leading Edge

ITALY'S GHIA DESIGN studio and Ford have unveiled the Seatta concept car, which interprets "edge" design—a reaction against smooth corners. The Seatta is intended as a lightweight, affordable, open-top roadster. If softtops in winter aren't for you, a hardtop is also available.

This Time, with Color

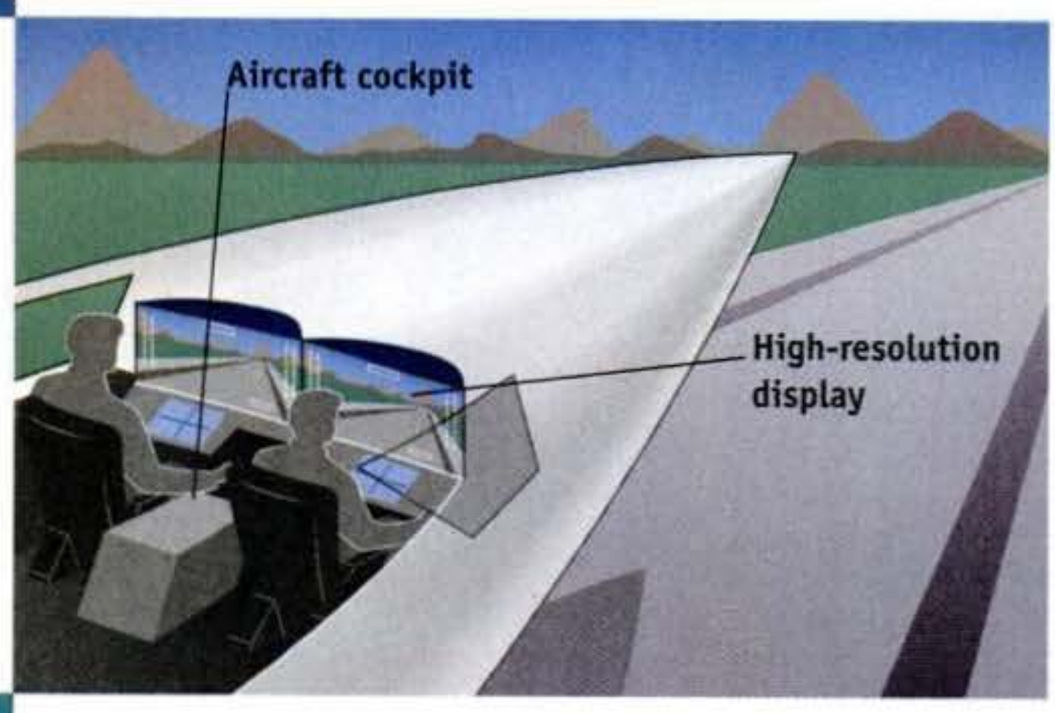
THE VIVID 5-INCH backlit color display would be enough to grab your eye in Sharp's MI-10DC Color Zaurus personal digital assistant. But the device also comes with a digital camera attachment, Internet access software, and audio recording capability. The pen-based unit runs for eight hours on a rechargeable lithium-ion battery.

Cool Cat

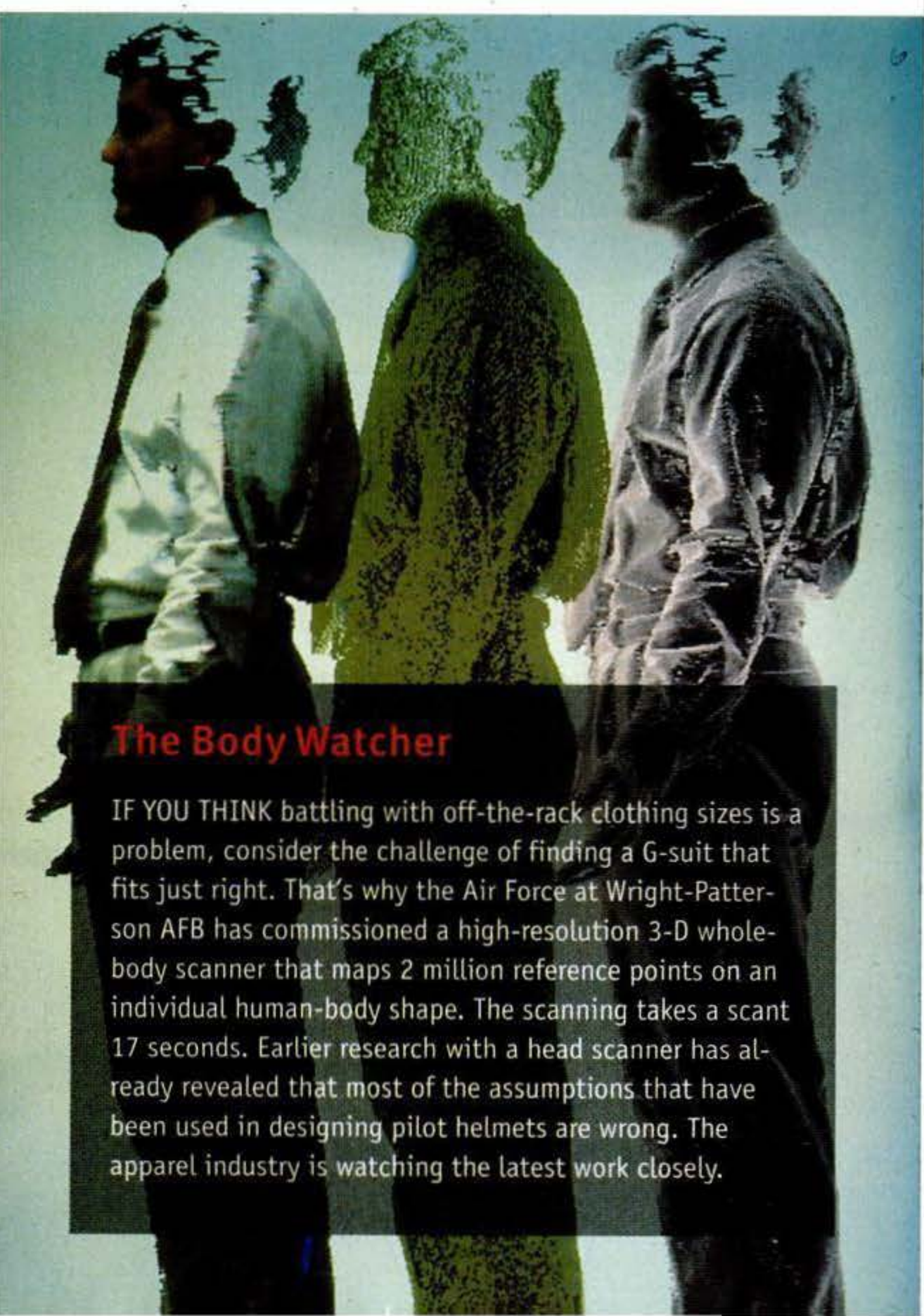
THE SPORTY open-topped Lynx concept car is based on the Fiesta and is targeted for production early next year, probably as the Puma. The doors have no external handles and are unlocked and opened by swiping a smart card between concealed contacts. Built on a 96-inch wheelbase, the 13.4-foot-long Lynx is powered by a 120-horsepower version of Ford's ZETEC-SE 11.7-liter engine. Ford of Europe, Brentwood, Essex CM13 3BW, England.

Supersonic Nose Job

NASA HAS FLIGHT-TESTED a "windowless" landing system that would cut the droopy nose off the Concorde and other SSTs. "Synthetic vision" replaces forward-looking windows with a high-resolution display that uses a digital video camera, infrared cameras, and microwave radar. The pilot no longer needs to see directly in front, so it's good-bye to the costly, complex mechanical nose. NASA hopes to have the system available by 2000.

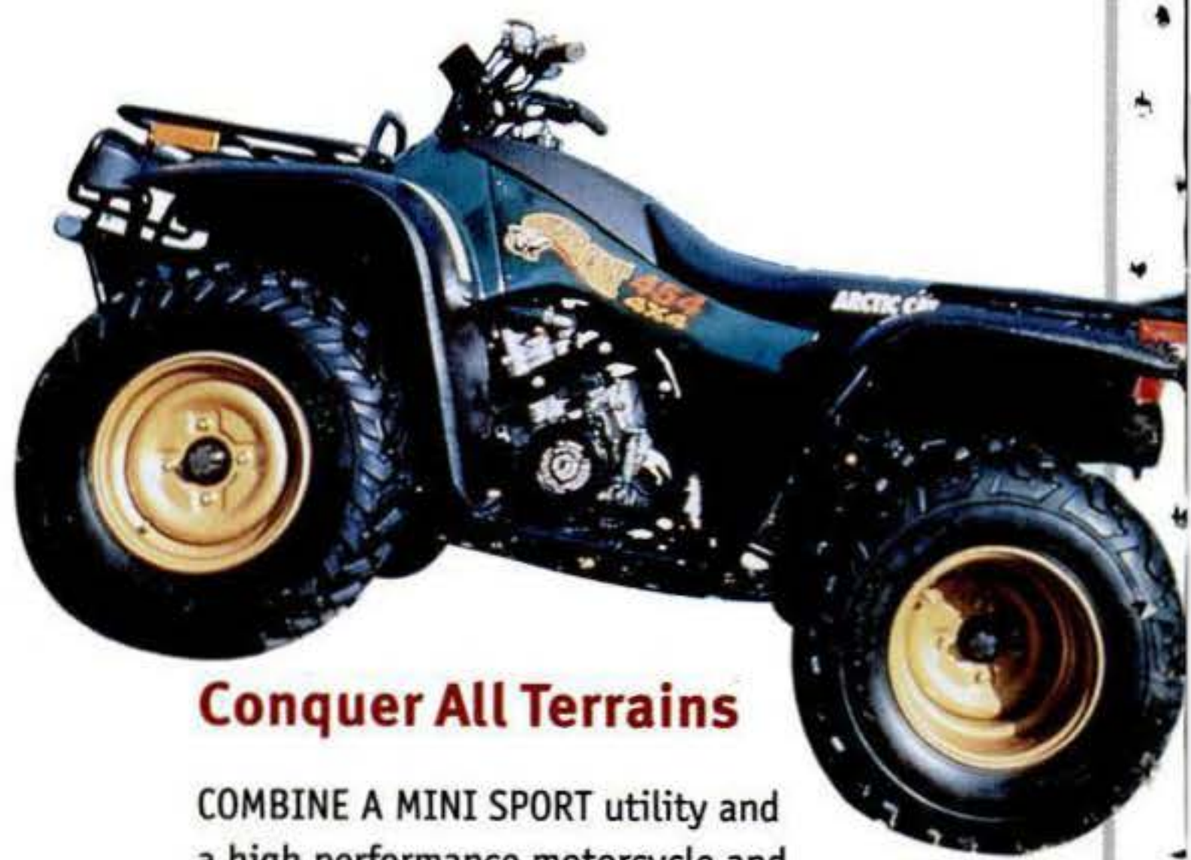


GREG MAXSON



The Body Watcher

IF YOU THINK battling with off-the-rack clothing sizes is a problem, consider the challenge of finding a G-suit that fits just right. That's why the Air Force at Wright-Patterson AFB has commissioned a high-resolution 3-D whole-body scanner that maps 2 million reference points on an individual human-body shape. The scanning takes a scant 17 seconds. Earlier research with a head scanner has already revealed that most of the assumptions that have been used in designing pilot helmets are wrong. The apparel industry is watching the latest work closely.



Conquer All Terrains

COMBINE A MINI SPORT utility and a high performance motorcycle and you have the new Arctic Cat Bearcat, an ATV (all-terrain vehicle) with a 454-cc liquid-cooled engine. A fully independent front suspension and semi-independent rear axle provide high ground clearance and good ride. The gearbox includes a low range for stump-pulling power.

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Robo Copter

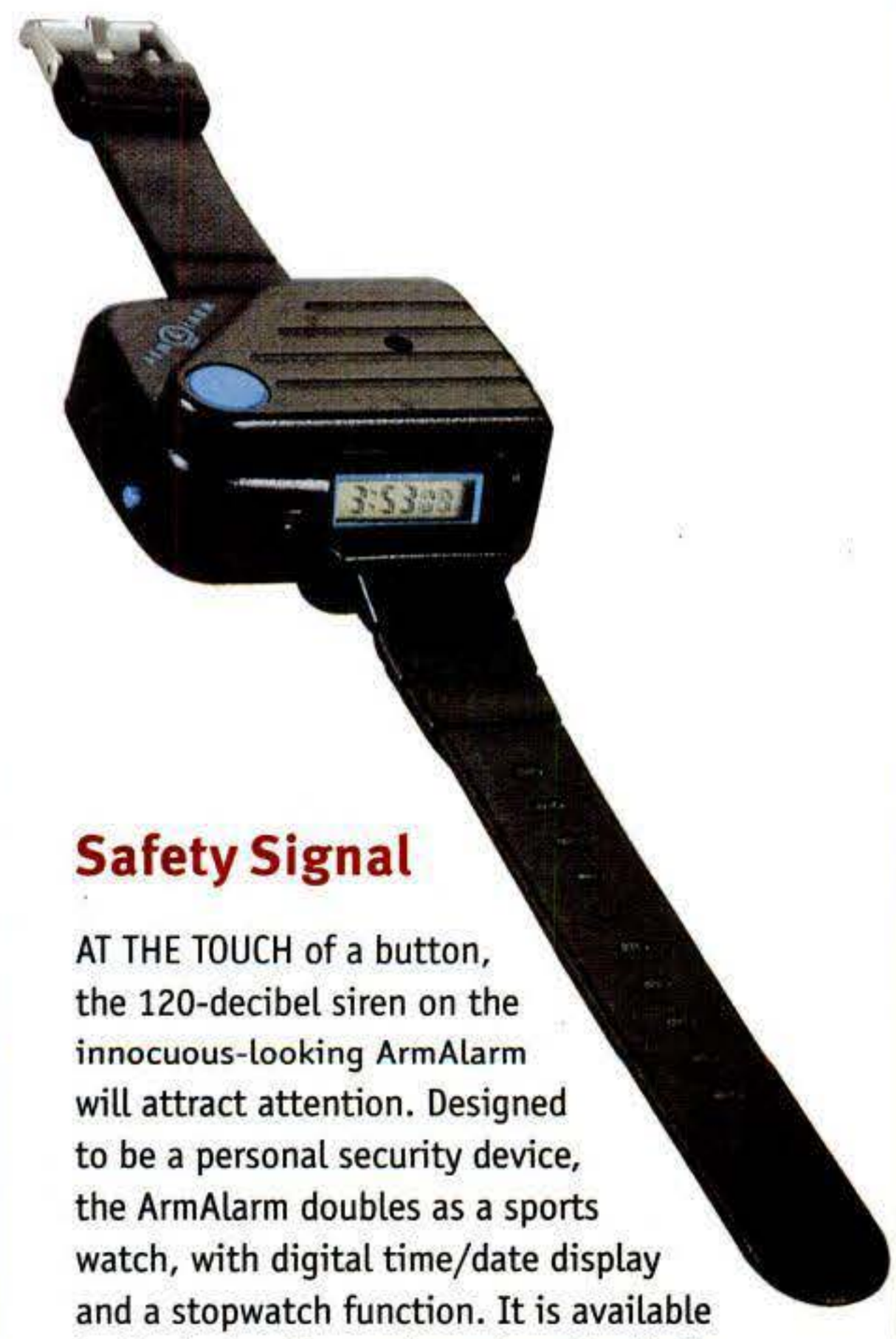
CARNEGIE MELLON University's robotic helicopter was designed for missions too dangerous for humans, such as fire fighting and search-and-rescue. The machine's distinctive vision system locks onto objects on the ground, then automatically keeps them in view while it hovers above. The 14-foot-long autonomous helicopter was developed from a Yamaha crop duster.

Eye Spy

THE MTI PHOTOSCREENER is the world's only portable, instant-photo vision screener, according to the manufacturer. This computerized flash camera is particularly beneficial with young children, because it works without head restraint or dilation of the eye. A variety of disorders are immediately spotted by analysis of light reflected from the retina (inset). Cost: about $2,950. Medical Technology & Innovations, 3125 Nolt Rd., Lancaster PA 17601.

"Nature" Comes Inside

INTERIOR TREES, A CONCEPT for emulating natural shapes while delivering utilities to an area within a building, would enable individuals to adjust the lighting and temperature beneath each canopy. Developed by USG Interiors of Chicago, the structures' "trunks" contain outlets for electric wiring and data cables, and ducts for warm or cool air. Lighting fixtures are built into "branches."



Safety Signal

AT THE TOUCH of a button, the 120-decibel siren on the innocuous-looking ArmAlarm will attract attention. Designed to be a personal security device, the ArmAlarm doubles as a sports watch, with digital time/date display and a stopwatch function. It is available in black, fuschia, and purple and sells for about $40. Direct Safety Solutions, 823 Menendez Court, Orlando FL 32801.

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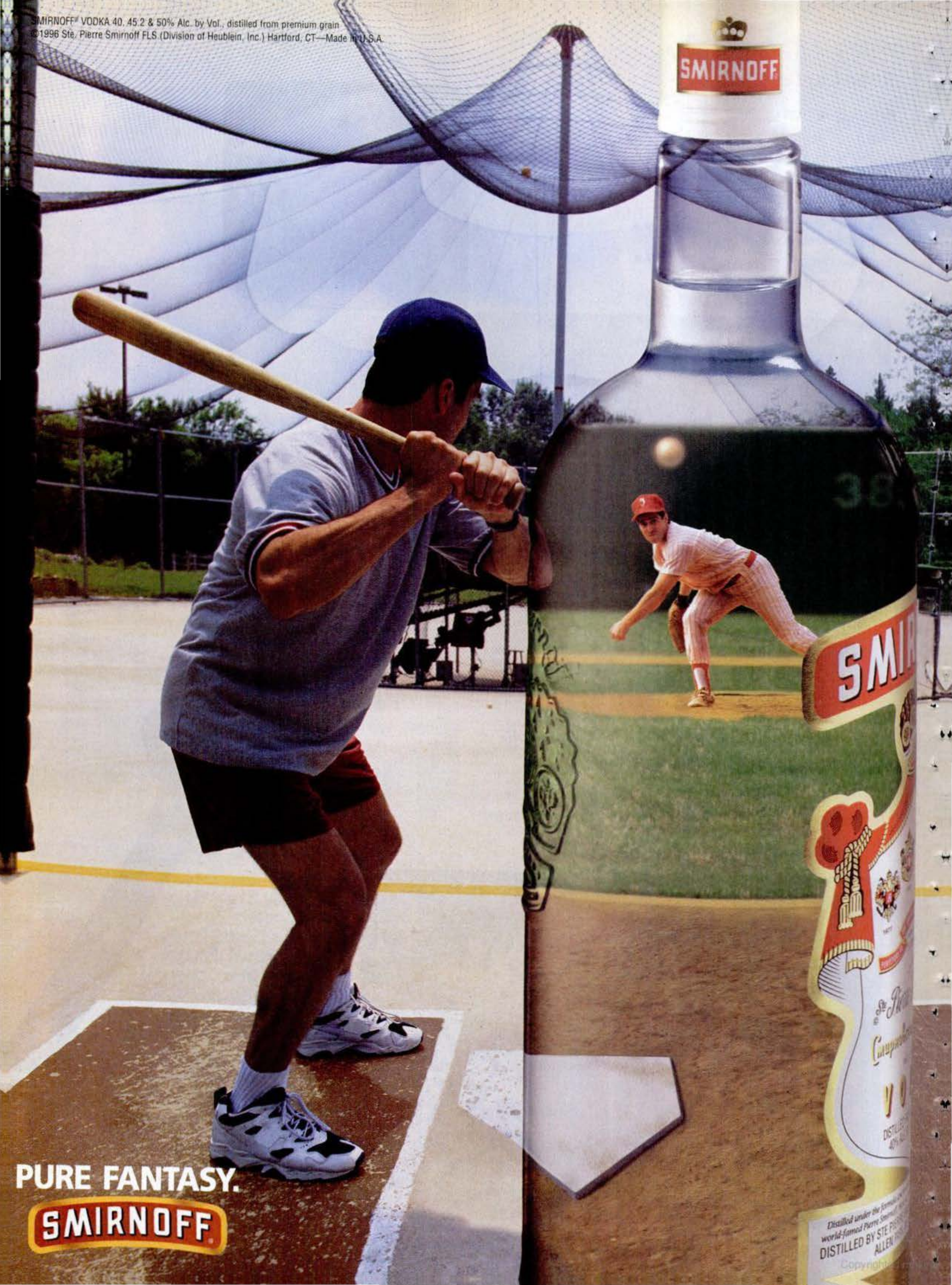
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3. Sweepstakes open to residents of the U.S. who are 21 years of age or older as of June 15, 1996, except employees and their families of Heublein, Inc., their wholesalers, distributors, retailers, TIMES MIRROR MAGAZINES, their affiliates, subsidiaries, promotional and advertising agencies. This offer is void in the state of Utah and wherever else prohibited or restricted by national, state or any other governmental laws. Subject to all federal, state and local laws.
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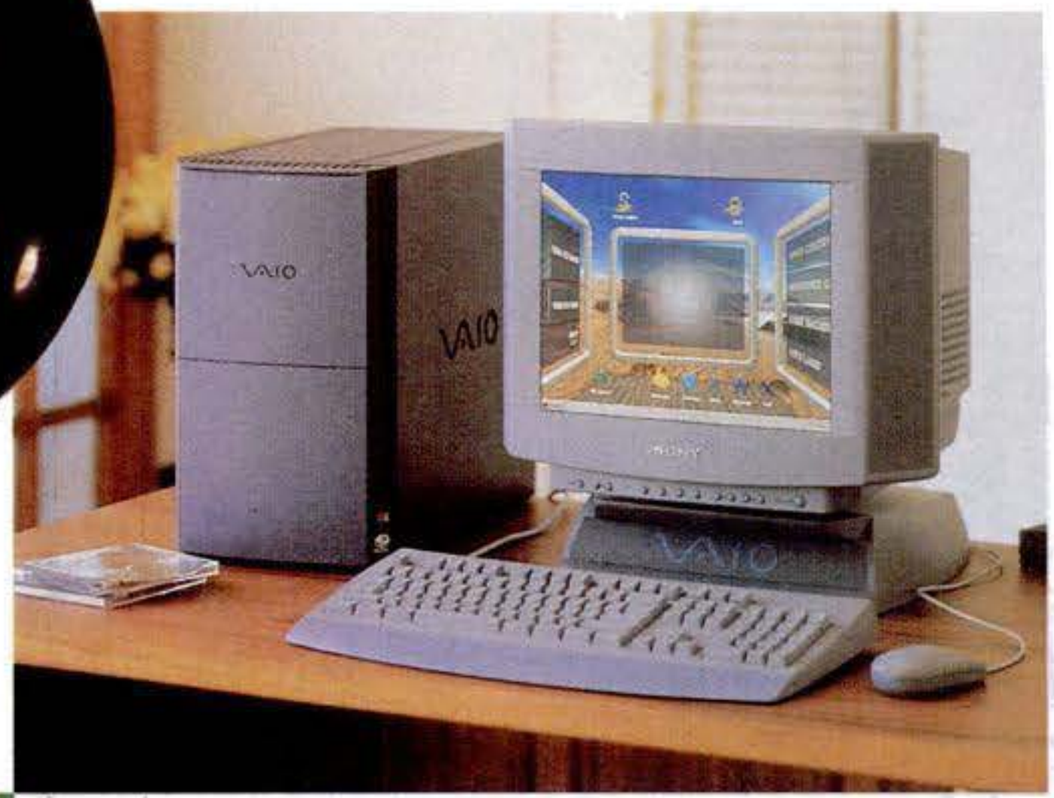
Split Skates

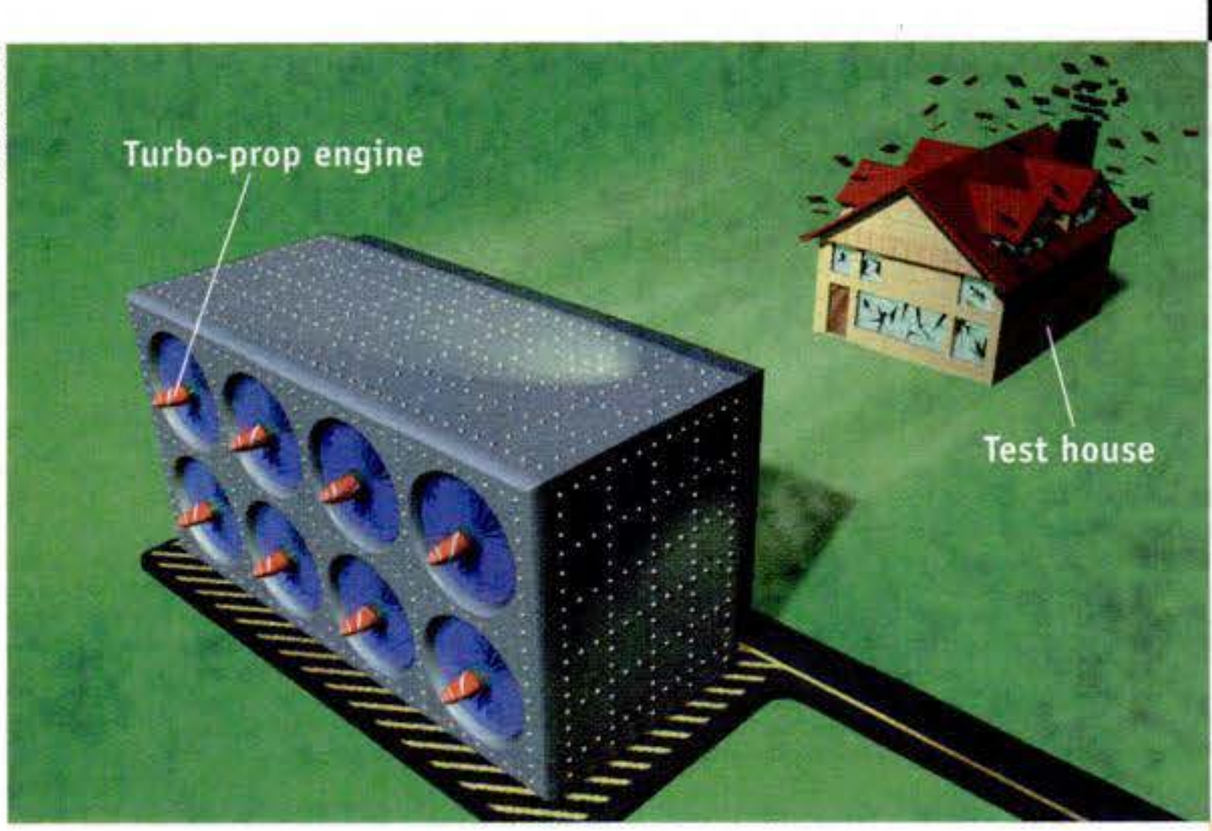
TURN MORE TIGHTLY and smoothly while inline skating with California Pro's new Twin Chassis design. It lets the front and rear two wheels move independently. The extra flexibility means that when you turn, the skate rides on two wheels. The design also provides shock absorption. Price: about $150.



My First Sony PC

SONY BRINGS ITS audio and video expertise to computers with the new PCV-70 and PCV-90 (shown) models. Each comes with a high-speed Pentium processor, 16MB of memory, and an 8X CD-ROM drive. But the Sony PC's real strength is its 3-D graphics, smooth MPEG motion video, and unusual video display unit, which houses a brilliant 15-inch Trinitron monitor and a three-speaker system. Prices are expected to range between $2,000 and $3,000.

ANDY CHISTIE



Big Bad Wolf Meets His Match

WIND TUNNELS, scale-model shake tables, and computer models aren't sufficient to test buildings thoroughly against storms and earthquakes, say researchers at the Idaho National Engineering Laboratory. They have a bigger idea: On a site the size of Rhode Island, they propose to build a $200 million Advanced Combined Environments Test Station. It will blast 200-mph winds from eight turbo-prop engines at a full-scale two-story house. Earthquakes will be simulated with billion-watt loudspeaker coils or propane-detonation cannons.

Cool Comfort

THE FIRST RESIDENTIAL air conditioner to receive approval by Green Seal, a national environmental organization, the Carrier WeatherMaker 38TXA uses refrigerant 410a, which does not contain ozone-killing chlorine. The single-speed unit has a respectable Seasonal Energy Efficiency Ratio (SEER) of 13.0. And it's quiet, too, with a decibel level of about 71. (Typical air conditioners average about 80 decibels.)

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KICK TOENAIL FUNGUS.

TOENAIL WITH FUNGUS.

IF YOU THINK YOU HAVE TOENAIL FUNGUS, ASK YOUR DOCTOR OR CALL 1-800-595-NAILS.

Take **SPORANOX** treatment orally for just 3 months and you may see a visible difference.

Soon after you stop taking SPORANOX, you may notice that the new nail growing in appears normal. Since nails need time to grow, you should expect it to be several months before healthy, new nails grow in.

So, now you can give thick, yellowing, brittle nails the boot and start growing fresh, new nails!

Ask your doctor or other healthcare professional about prescribing SPORANOX today. For more information, call

1-800-595-NAILS ext. 225

What you should know about the safety of SPORANOX: SPORANOX has been well tolerated in patients. In clinical trials involving patients with thick, hard, yellowish, and/or brittle nails (onychomycosis), the following adverse effects led to either a temporary or a permanent discontinuation of treatment: elevated liver enzymes (4%), gastrointestinal disorders (4%), and rash (3%).

WARNING: SPORANOX must not be taken with terfenadine (Seldane®), astemizole (Hismanal®), cisapride (Propulsid®), or oral triazolam (Halcion®).

In rare instances, there were reports of elevated liver enzymes and hepatitis. (If clinical signs and symptoms consistent with liver disease develop, SPORANOX should be discontinued.) If you're pregnant or considering pregnancy, you should not take SPORANOX. Take SPORANOX only as directed by your doctor, and report any adverse effects to your doctor as soon as possible.

world leader in antifungal research

JANSSEN · PHARMACEUTICA · RESEARCH FOUNDATION ·

Titusville, NJ 08560-0200

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NOW 100 mg

sporanox®

(itraconazole capsules)

PLEASE SEE IMPORTANT PRECAUTIONARY INFORMATION ON ADJACENT PAGE.

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100 mg

sporanox®

(itraconazole capsules)

Before prescribing, please consult complete prescribing information of which the following is a brief summary.

WARNING: Coadministration of terfenadine with itraconazole is contraindicated. Serious cardiovascular adverse events, including death, ventricular tachycardia, and torsades de pointes have occurred in patients taking itraconazole concomitantly with terfenadine. This is due to elevated terfenadine concentrations caused by itraconazole. See CONTRAINDICATIONS, WARNINGS, and PRECAUTIONS sections.

Another oral azole antifungal, ketoconazole, inhibits the metabolism of astemizole, resulting in elevated plasma concentrations of astemizole and its active metabolite desmethylastemizole, which may prolong QT intervals. Based on results of an *in vitro* study and the chemical resemblance of itraconazole and ketoconazole, coadministration of astemizole and itraconazole is contraindicated. See CONTRAINDICATIONS, WARNINGS, and PRECAUTIONS sections.

Coadministration of cisapride with itraconazole is contraindicated. Serious cardiovascular adverse events including death, ventricular tachycardia, and torsades de pointes have occurred in patients taking itraconazole concomitantly with cisapride. See CONTRAINDICATIONS, WARNINGS, and PRECAUTIONS sections.

INDICATIONS AND USAGE

SPORANOX (itraconazole capsules) is indicated for the treatment of the following fungal infections in immunocompromised and non-immunocompromised patients:

1. Blastomycosis, pulmonary and extrapulmonary;
2. Histoplasmosis, including chronic cavitary pulmonary disease and disseminated, non-meningeal histoplasmosis;
3. Aspergillosis, pulmonary and extrapulmonary, in patients who are intolerant of or who are refractory to amphotericin B therapy; and
4. Onychomycosis due to dermatophytes (tinea unguium) of the toenail with or without fingernail involvement.

CONTRAINDICATIONS

Coadministration of terfenadine, astemizole or cisapride with SPORANOX (itraconazole capsules) is contraindicated. (See BOX WARNING, WARNINGS, and PRECAUTIONS sections.)

Concomitant administration of SPORANOX with oral triazolam or with oral midazolam is contraindicated. (See PRECAUTIONS section.)

SPORANOX should not be administered for the treatment of onychomycosis to pregnant patients or to women contemplating pregnancy.

SPORANOX is contraindicated in patients who have shown hypersensitivity to the drug or its excipients. There is no information regarding cross hypersensitivity between itraconazole and other azole antifungal agents. Caution should be used in prescribing SPORANOX to patients with hypersensitivity to other azoles.

WARNINGS

In U.S. clinical trials prior to marketing, there have been three cases of reversible idiosyncratic hepatitis reported among more than 2500 patients taking SPORANOX (itraconazole capsules). One patient outside the U.S. developed fulminant hepatitis and died during SPORANOX administration. Since this patient was on multiple medications, the causal association with SPORANOX is uncertain. If clinical signs and symptoms consistent with liver disease develop that may be attributable to itraconazole, SPORANOX should be discontinued.

Prior to U.S. marketing, there have been three cases of life-threatening cardiac dysrhythmias and one death reported in patients receiving terfenadine and itraconazole. (See BOX WARNING, CONTRAINDICATIONS, and PRECAUTIONS sections.)

Coadministration of astemizole with SPORANOX is contraindicated. (See BOX WARNING, CONTRAINDICATIONS, and PRECAUTIONS sections.)

Concomitant administration of oral ketoconazole with cisapride has resulted in markedly elevated cisapride plasma concentrations, prolonged QT intervals, and has rarely been associated with ventricular arrhythmias and torsades de pointes. Due to potent *in vitro* inhibition of the hepatic enzyme system mainly responsible for the metabolism of cisapride (cytochrome P450 3A4), itraconazole is also expected to markedly raise cisapride plasma concentrations; therefore, concomitant use of cisapride with SPORANOX is contraindicated. (See BOX WARNING, CONTRAINDICATIONS, and PRECAUTIONS sections.)

PRECAUTIONS

General: Hepatic enzyme test values should be monitored in patients with preexisting hepatic function abnormalities. Hepatic enzyme test values should be monitored periodically in all patients receiving continuous treatment for more than one month or at any time a patient develops signs or symptoms suggestive of liver dysfunction.

SPORANOX (itraconazole capsules) should be administered after a full meal.

Under fasted conditions, itraconazole absorption was decreased in the presence of decreased gastric acidity. The absorption of itraconazole may be decreased with the concomitant administration of antacids or gastric acid secretion suppressors. Studies conducted under fasted conditions demonstrated that administration with 8 ounces of a cola beverage resulted in increased absorption of itraconazole in AIDS patients with relative or absolute achlorhydria. This increase relative to the effects of a full meal is unknown.

Information for patients: Patients should be instructed to take SPORANOX with a full meal.

Patients should be instructed to report any signs and symptoms that may suggest liver dysfunction so that the appropriate laboratory testing can be done. Such signs and symptoms may include unusual fatigue, anorexia, nausea and/or vomiting, jaundice, dark urine or pale stool.

Drug interactions: Both itraconazole and its major metabolite, hydroxyitraconazole, are inhibitors of the cytochrome P450 3A4 enzyme system. Coadministration of SPORANOX and drugs primarily metabolized by the cytochrome P450 3A4 enzyme system may result in increased plasma concentrations of the drugs that could increase or prolong both therapeutic and adverse effects. Therefore, unless otherwise specified, appropriate dosage adjustments may be necessary.

Coadministration of terfenadine with SPORANOX has led to elevated plasma concentrations of terfenadine, resulting in rare instances of life-threatening cardiac dysrhythmias and one death. (See BOX WARNING, CONTRAINDICATIONS, and WARNINGS sections.)

Another oral azole antifungal, ketoconazole, inhibits the metabolism of astemizole, resulting in elevated plasma concentrations of astemizole and its active metabolite desmethylastemizole which may prolong QT intervals. *In vitro* data suggest that itraconazole, when compared to ketoconazole, has a less pronounced effect on the biotransformation system responsible for the metabolism of astemizole. Based on the chemical resemblance of itraconazole and ketoconazole, coadministration of astemizole with itraconazole is contraindicated. (See BOX WARNING, CONTRAINDICATIONS, and WARNINGS sections.)

Human pharmacokinetics data indicate that oral ketoconazole potently inhibits the metabolism of cisapride resulting in an eight-fold increase in the mean AUC of cisapride. Data suggest that coadministration of oral ketoconazole and cisapride can result in prolongation of the QT interval on the ECG. *In vitro* data suggest that itraconazole also markedly inhibits the biotransformation system mainly responsible for the metabolism of cisapride; therefore concomitant administration of SPORANOX with cisapride is contraindicated. (See BOX WARNING, CONTRAINDICATIONS, and WARNINGS sections.)

Coadministration of SPORANOX with oral midazolam or triazolam has resulted in elevated plasma concentrations of the latter two drugs. This may potentiate and prolong hypnotic and sedative effects. These agents should not be used in patients treated with SPORANOX. If midazolam is administered parenterally, special precaution is required since the sedative effect may be prolonged. (See CONTRAINDICATIONS section.)

Coadministration of SPORANOX and cyclosporine, tacrolimus or digoxin has led to increased plasma concentrations of the latter three drugs. Cyclosporine, tacrolimus and digoxin concentrations should be monitored at the initiation of SPORANOX therapy and frequently thereafter, and the dose of these three drug products adjusted appropriately.

There have been rare reports of rhabdomyolysis involving renal transplant patients receiving the combination of SPORANOX, cyclosporine, and the HMG-CoA reductase inhibitors lovastatin or simvastatin. Rhabdomyolysis has been observed in patients receiving HMG-CoA reductase inhibitors administered alone (at recommended dosages) or concomitantly with immunosuppressive drugs including cyclosporine.

When SPORANOX was coadministered with phenytoin, rifampin, or H_2 antagonists, reduced plasma concentrations of itraconazole were reported. The physician is advised to monitor the plasma concentrations of itraconazole when any of these drugs is taken concurrently, and to increase the dose of SPORANOX if necessary. Although no studies have been conducted, concomitant administration of SPORANOX and phenytoin may alter the metabolism of phenytoin; therefore, plasma concentrations of phenytoin should also be monitored when it is given concurrently with SPORANOX.

It has been reported that SPORANOX enhances the anticoagulant effect of coumarin-like drugs. Therefore, prothrombin time should be carefully monitored in patients receiving SPORANOX and coumarin-like drugs simultaneously.

Plasma concentrations of azole antifungal agents are reduced when given concurrently with isoniazid. Itraconazole plasma concentrations should be monitored when SPORANOX and isoniazid are coadministered.

Severe hypoglycemia has been reported in patients concomitantly receiving azole antifungal agents and oral hypoglycemic agents. Blood glucose concentrations should be carefully monitored when SPORANOX and oral hypoglycemic agents are coadministered.

Tinnitus and decreased hearing have been reported in patients concomitantly receiving SPORANOX and quinidine. Edema has been reported in patients concomitantly receiving SPORANOX and dihydropyridine calcium channel blockers. Appropriate dosage adjustments may be necessary.

The results from a study in which eight HIV-infected individuals were treated with zidovudine, 8±0.4 mg/kg/day, showed that the pharmacokinetics of zidovudine were not affected during concomitant administration of SPORANOX, 100 mg b.i.d.

Carcinogenesis, Mutagenesis and Impairment of Fertility: Itraconazole showed no evidence of carcinogenicity potential in mice treated orally for 23 months at dosage levels up to 80 mg/kg/day [approximately 10x the maximum recommended human dose (MRHD)]. Male rats treated with 25 mg/kg/day (3.1x MRHD) had a slightly increased incidence of soft tissue sarcoma. These sarcomas may have been a consequence of hypercholesterolemia, which is a response of rats, but not dogs or humans, to chronic itraconazole administration. Female rats treated with 50 mg/kg/day (6.25x MRHD) had an increased incidence of squamous cell carcinoma of the lung (2/50) as compared to the untreated group. Although the occurrence of squamous cell carcinoma in the lung is extremely uncommon in untreated rats, the increase in this study was not statistically significant.

Itraconazole produced no mutagenic effects when assayed in appropriate bacterial, non-mammalian and mammalian test systems.

Itraconazole did not affect the fertility of male or female rats treated orally with dosage levels of up to 40 mg/kg/day (5x MRHD) even though parental toxicity was present at this dosage level. More severe signs of parental toxicity, including death, were present in the next higher dosage level, 160 mg/kg/day (20x MRHD).

Pregnancy: Teratogenic Effects. Pregnancy Category C: Itraconazole was found to cause a dose-related increase in maternal toxicity, embryotoxicity and teratogenicity in rats at dosage levels of approximately 40-160 mg/kg/day (5-20x MRHD) and in mice at dosage levels of approximately 80 mg/kg/day (10x MRHD). In rats, the teratogenicity consisted of major skeletal defects; in mice it consisted of encephaloceles and/or macroglossia.

There are no studies in pregnant women. SPORANOX should be used for the treatment of systemic fungal infections in pregnancy only if the benefit outweighs the potential risk. SPORANOX should not be administered for the treatment of onychomycosis to pregnant patients or to women contemplating pregnancy. SPORANOX should not be administered to women of child-bearing potential for the treatment of onychomycosis unless they are taking effective measures to prevent pregnancy and the patient begins therapy on the second or third day of the next normal menstrual period. Effective contraception should be continued throughout SPORANOX therapy and for 2 months following treatment.

Nursing Mothers: Itraconazole is excreted in human milk; therefore, SPORANOX should not be administered to nursing women.

Pediatric Use: The efficacy and safety of SPORANOX have not been established in pediatric patients. No pharmacokinetic data are available in children. A small number of patients age 3 to 16 years have been treated with 100 mg/day of itraconazole for systemic fungal infections and no serious unexpected adverse effects have been reported.

In three toxicology studies using rats, itraconazole induced bone defects at dosage levels as low as 20 mg/kg/day (2.5x MRHD). The induced defects included reduced bone plate activity, thinning of the zona compacta of the large bones and increased bone fragility. At a dosage level of 80 mg/kg/day (10x MRHD) over one year or 160 mg/kg/day (20x MRHD) for six months, itraconazole induced small tooth pulp with hypocellular appearance in some rats.

While no such bone toxicity has been reported in adult patients, the long term effect of itraconazole in pediatric patients is unknown.

HIV-infected Patients: Because hypochlorhydria has been reported in HIV-infected individuals, the absorption of itraconazole in these patients may be decreased.

The results from a study in which eight HIV-infected individuals were treated with zidovudine, 8±0.4 mg/kg/day, showed that the pharmacokinetics of zidovudine were not affected during concomitant administration of SPORANOX, 100 mg b.i.d.

ADVERSE REACTIONS

In U.S. clinical trials prior to marketing, there have been three cases of reversible idiosyncratic hepatitis reported among more than 2500 patients. One patient outside the U.S. developed fulminant hepatitis and died during SPORANOX (itraconazole capsules) administration. Because this patient was on multiple medications, the causal association with SPORANOX is uncertain. (See WARNINGS section.)

ONYCHOMYCOSIS:

Adverse events in the following table led to either temporary or permanent discontinuation of treatment:

Body System/Adverse Event	Incidence (%) (n=112)
Elevated Liver Enzymes (>2x normal range)	4%
Gastrointestinal Disorders	4%
Rash	3%
Hypertension	2%
Orthostatic Hypotension	1%

Body System/Adverse Event	Incidence (%) (n=112)
Headache	1%
Malaise	1%
Myalgia	1%
Vasculitis	1%
Vertigo	1%

SYSTEMIC FUNGAL INFECTIONS:

Adverse experience data in the following table are derived from 602 patients treated for systemic fungal disease in U.S. clinical trials, who were immunocompromised or receiving multiple concomitant medications. Of these patients, treatment was discontinued in 10.5% of patients due to adverse events. The median duration before discontinuation of therapy was 81 days, with a range of 2-776 days. The table lists adverse events reported by at least 1% of patients.

Body System/Adverse Event (Incidence ≥ 1%)	Incidence (%)
Gastrointestinal Disorders	
Nausea	10.6
Vomiting	5.1
Diarrhea	3.3
Abdominal Pain	1.5
Anorexia	1.2
Body as a Whole	
Edema	3.5
Fatigue	2.8
Fever	2.5
Malaise	1.2
Skin and Appendages	
Rash	8.6*
Pruritus	2.5
Central and Peripheral Nervous System	
Headache	3.8
Dizziness	1.7

Body System/Adverse Event (Incidence ≥ 1%)	Incidence (%)
Psychiatric Disorders	
Libido decreased	1.2
Somnolence	1.2
Cardiovascular Disorders	
Hypertension	3.2
Metabolic and Nutritional Disorders	
Hypokalemia	2.0
Urinary System Disorders	
Albuminuria	1.2
Liver and Biliary System Disorders	
Hepatic function abnormal	2.7
Reproductive Disorders, Male	
Impotence	1.2

*Rash tends to occur more frequently in immunocompromised patients receiving immunosuppressive medications.

Adverse events infrequently reported in all studies included: constipation, gastritis, depression, insomnia, tinnitus, menstrual disorder, adrenal insufficiency, gynecomastia and male breast pain.

In worldwide postmarketing experience with SPORANOX, allergic reactions including rash, pruritus, urticaria, angioedema and in rare instances, anaphylaxis and Stevens-Johnson syndrome, have been reported. Marketing experiences have also included reports of elevated liver enzymes and rare hepatitis. Although the causal association with SPORANOX is uncertain, rare hypertriglyceridemia and isolated cases of neuropathy have also been reported.

OVERDOSAGE

Itraconazole is not removed by dialysis. In the event of accidental overdosage, supportive measures, including gastric lavage with sodium bicarbonate, should be employed.

No significant lethality was observed when itraconazole was administered orally to mice and rats at dosage levels of 320 mg/kg or to dogs at 200 mg/kg.

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world leader in antimycotic research

JANSSEN PHARMACEUTICA RESEARCH FOUNDATION

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Self-Sizing Pliers

ORDINARY LOCKING PLIERS have to be adjusted with a screw, depending on the thickness of the object you want to grip. But with the Sears Craftsman Auto Lock pliers, sizing is automatic. You merely position the jaws around any object up to an inch thick and squeeze the handles. The gripping force of the pliers, which is preset for 500 pounds, is adjustable. Prices: about $22 for the 7-inch straight-jaw pliers; about $30 for the 9-inch curved-jaws.

Kiddie Keys

DESIGNED for preschoolers, Smart Keys keyboard from Vtech combines big, colorful letter and number keys on a musical keyboard that lights up. Two CD-ROM games, The Incredible Science Chase and Mice Melodies, are included. For Windows PCs, $80. Vtech, 101 E. Paltine Rd., Wheeling IL 60090.

Palmtop Windows

TOSHIBA USED ITS miniaturizing skills to produce what it claims is the smallest and lightest palmtop to be compatible with Windows 95. The Libretto is 8.3 inches by 4.5 inches by 1.3 inches and weighs a mere 29 ounces. Already on sale in Japan for about $1,780; Toshiba is considering overseas sales.

Hot Off the Presses

THE PRINT-IT PERSONAL Photographic Print Maker is touted as the first home-use printer to handle both video and digital data. Want even more convenience? There's no need to change ink cartridges—the ink is in the paper. A thermo-autochrome process creates an image by heating the yellow, magenta, and cyan color emitters embedded in the paper. The result: a 24-bit color image with 150-dpi resolution within two minutes. For Windows PCs; a Mac driver kit is planned for the fall. Price: $699. Fuji Photo Film USA, 555 Taxter Rd., Elmsford NY 10523.

APV Tryout

MAZDA HAS MODIFIED its new-for-1996 multipurpose minivan with an All-Sport package that includes larger tires. The result? An all-purpose vehicle that's a cross between a minivan and a sport utility. The All-Sport package is being tested for consumer acceptance and may be offered as an option later this year. Mazda's 1996 standard MPV features dual airbags, four doors, four-wheel ABS, and the ability to shift into four-wheel drive.

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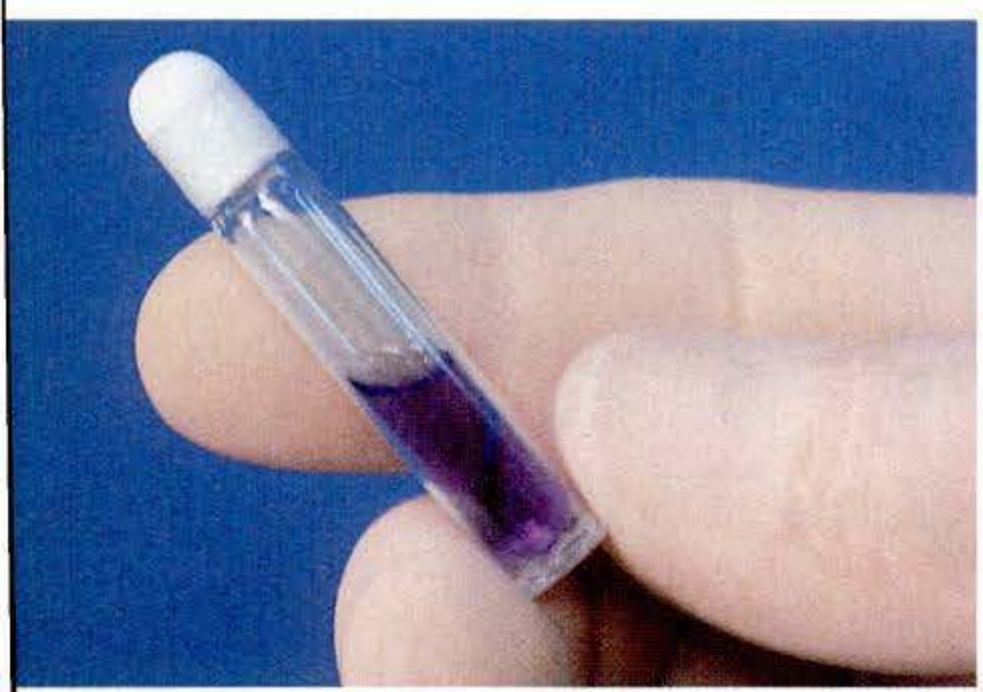
Simple Changes

KAI'S POWER GOO enables you to shrink, grow, twist, smudge, and otherwise distort images quickly and easily. Instead of tedious pixel-by-pixel manipulation, Kai's Power Goo lets you click and drag pieces of the image, changing it as you go. One click and you can reset the image, or you can "ungoo" what you've done, step-by-step. Price: $50. MetaTools, 6303 Carpinteria Av., Carpenteria CA 93013.

Gel Bandaid

INSTEAD OF USING SCAR-PRODUCING sutures, physicians could soon close wounds with TraumaSeal, a medical adhesive that goes on like a lip-balm stick. The biodegradable adhesive also eliminates the need for a return visit. TraumaSeal is in clinical trials at 10 hospitals and heath-care institutions around the country. Tri-Point Medical, 5265 Capital Blvd., Raleigh NC 27604.



See Bill Work

WANT A TOUR of the White House without the travel or the long lines? Inside the White House CD-ROM offers just that, with a few extras you won't see on the official walk-through—like a Presidential Morph (watch George Bush turn into Bill Clinton) and the text of every inaugural address. An Internet feature helps you connect to White House-related Web sites. For Windows PCs and Macs, $25. Thnyx, 619 Alexander Rd., Princeton NJ 08540.

Mall Talkies

NEXT TIME YOUR FAMILY spreads out in a shopping mall or visits a ski slope, you may want to outfit them with mini walkie-talkies. With a range of up to two miles, Motorola's Sport 7 ($139 per pair) and Sport 7x ($169) offer seven channels plus user-designated codes so that you hear only the people on your channel who are also on your code.

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NEWSFRONTS

SCIENCE & TECHNOLOGY

EDITED BY MARIETTE DiCHRISTINA

THE SUN

Our Violent Star

EVERY SCHOOLCHILD has heard the same story: Our sun is a rather dull, typical star. Not so. As scientists are now learning, even when it's relatively "quiet," the sun is remarkably turbulent.

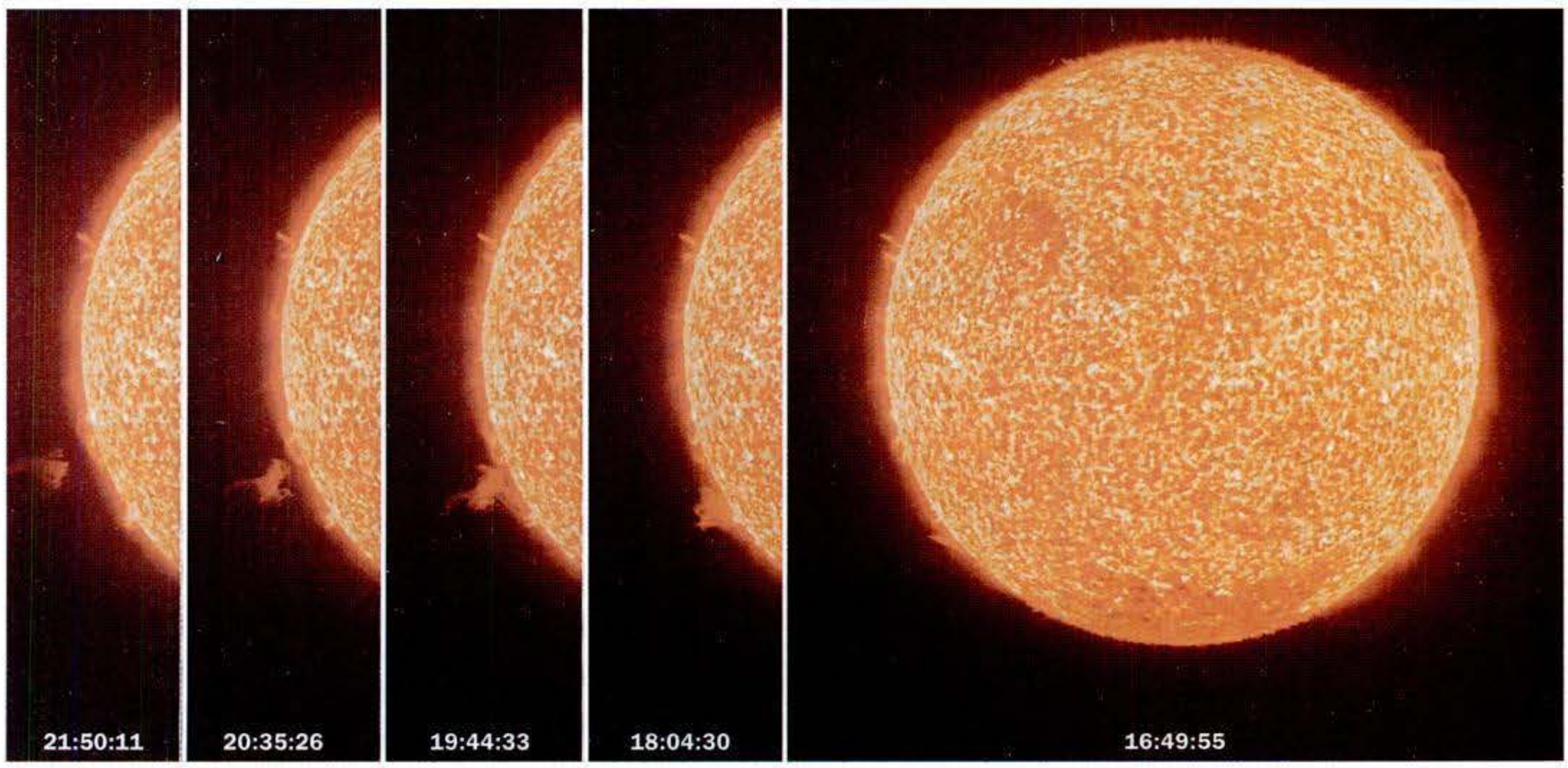
The new understanding comes courtesy of the first unblinking 24-hours-a-day view of the sun from the Solar Heliospheric Observatory, or SOHO. SOHO is a $1.1 billion spacecraft carrying a dozen instruments developed by the European Space Agency and operated collaboratively with NASA. It was launched last December 2 from Cape Canaveral, Florida, for a 30-month mission, and it now orbits about one million miles sunward of Earth, where the gravitational pulls of our sun and our planet cancel each other out.

Among SOHO's chief tasks is an investigation of the interior structure and dynamics of the sun as well as its corona, or outer atmosphere. The observatory was launched during the sun's so-called slow period, the time in its 11-year-or-so cycle when there is a reduction in the number of sunspots; the idea was to measure the sun's "baseline" against increasing activity.

What SOHO has found is a roiling, violent sun. As scientists had suspected, much of the sun's behavior is largely due to changing magnetic-field lines; ionized gases in the corona follow these lines, revealing structures underneath.

Some explanations are even in the offing for long-standing puzzles. For instance, scientists have wondered why the corona is 1 million°C, while the sun's surface (photosphere) is 5,600°C. In an area where solar-atmosphere temperatures were rapidly rising, SOHO observed small explosions—some 20,000 per minute—that may be fueled by shifting magnetic fields.

Analyzing the solar winds, charged gases, and particles that stream from the sun has brought additional news. Amounts of isotopes of magnesium detected at the sun's surface closely match those that are found on Earth—perhaps giving an indicator of the primordial makeup of the solar system.—*M.D.*



Right to left, SOHO captures successive images of an 80,000-mile-long fiery jet of 60,000°C gas erupting outward from the sun at 15,000 mph.

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THE HUMAN BODY

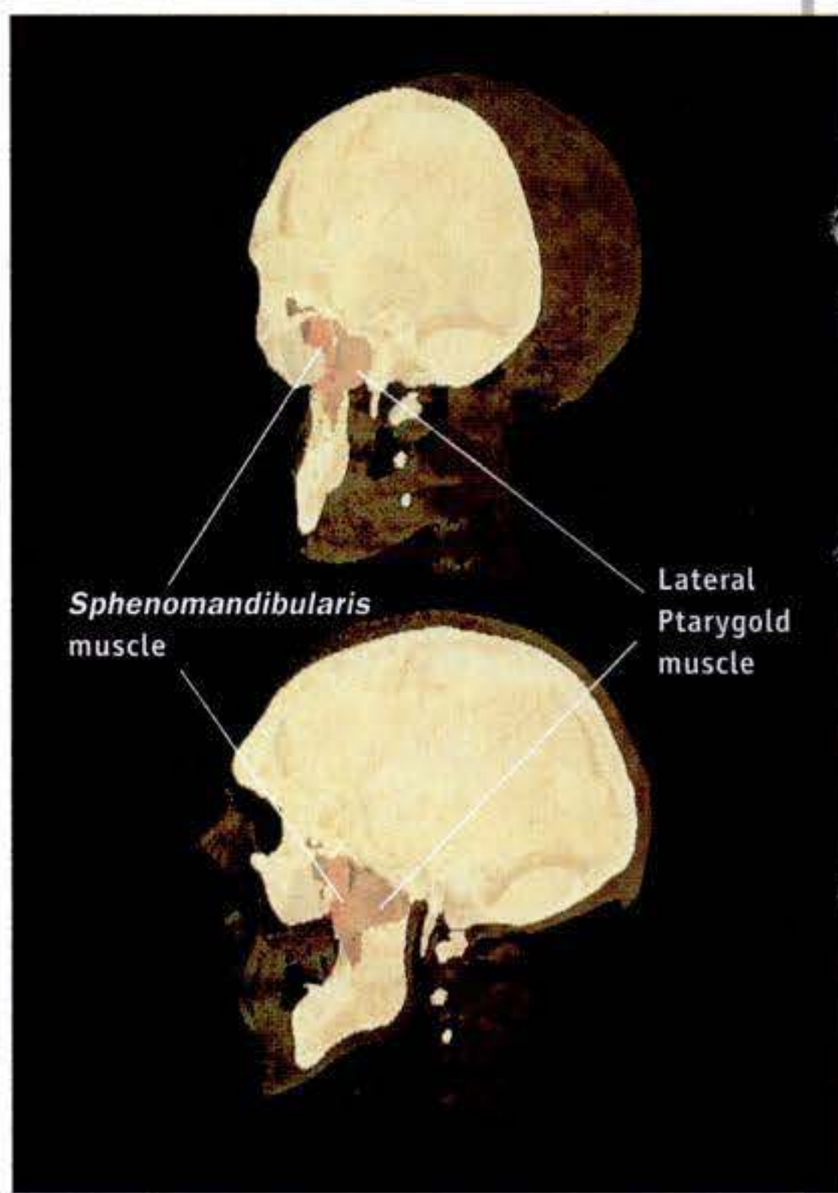
In Your Face

WHEN TWO DENTISTS were performing a routine autopsy, they stumbled upon something that made their jaws drop.

Dr. Gary Hack, professor of dentistry at the University of Maryland at Baltimore, and Dr. Gwendolyn Dunn, an orthodontist, were studying a joint disorder involving the lower jaw. But instead of taking the traditional approach for autopsy examinations—through the side of the head—they decided to go through the face. They found a surprise: a new muscle, extending from behind the eye to the jaw. "There was no description of this muscle in any textbook," says Dr. Dunn.

They suggested a name for the new muscle, *sphenomandibularis*, to indicate its attachment at the sphenoid (base of the head) and the mandible, or jaw. Skeptics have argued that the muscle is merely an extension of one of the four known muscles for chewing. But Hack and Dunn haven't gnashed their teeth, as other experts have come to their defense.

In a preliminary analysis, Dr. Peter Reiser, muscle physiologist at Ohio State University College of Dentistry, indicated that *sphenomandibularis* has a different biochemical composition than the chewing muscles. He and Hack suggest that *sphenomandibularis* may be less involved in chewing, and more responsible for stabilizing the jaw—allowing it to remain closed against gravity. So much for making jaws drop.—*Erica Garcia*



Discovery of a new muscle has dentists chewing over the news. It is also now part of an interactive atlas, called The Dissectable Human CD-ROM, from Engineering Animation of Ames, Iowa (right).

AVIATION

Vanishing Hornet

THE U.S. NAVY'S new F/A-18E/F Super Hornet strike fighter looks a lot like the older, smaller F/A-18 Hornet on which its design is based. But there the resemblance mostly ends: McDonnell Douglas has built a great deal of stealth technology into the new fighter.

To help bounce signals away from the radar that transmitted them, the Super Hornet's engine inlets and body sides have been flattened out and angled so that they line up with the wing and tail edges. The saw-tooth in the wing leading edge is shaped to avoid a radar "hot spot"; two "fences" above the body, fitted to the original Hornet to improve its maneuverability, have been replaced by small flaps. Each engine inlet has a baffle that blocks radar reflections from the metal fan blades.

The F/A-18E/F Super Hornet's conventional appearance belies its stealthy nature.

McDonnell Douglas has attempted to make the original Hornet less visible to radar before, but ran into two problems. The job required 240 pounds of radar-absorbent material (RAM)—a great deal of extra weight for a fighter. Also, the RAM was made from iron particles in a paintlike binder, and it rusted aboard Navy aircraft carriers. By changing the Super Hornet's shape, McDonnell Douglas was able to give it a smaller radar image than the older aircraft while using less RAM. And the RAM is now corrosion-resistant and does not contain iron.—*Bill Sweetman*

MEDICINE

Artificial Blood

FOR DECADES, scientists have sought a blood substitute that could keep seriously injured people alive until they receive a transfusion. Success may lie in "hemoglobin solutions" now being tested on humans in clinical trials administered by seven companies in Europe and the United States. Mimicking ordinary hemoglobin, these compounds could maintain blood pressure and distribute oxygen throughout the body temporarily, until normal blood levels are restored. Blood substitutes also offer a longer shelf life and reduced contamination risk.

"This could get you through an immediate crisis," notes Martha Farmer, a scientist at Baxter International. The Illinois-based biotech company hopes to market its product, HemAssist, by late 1997 in Europe and late 1998 in the United States.—*Steve Nadis*

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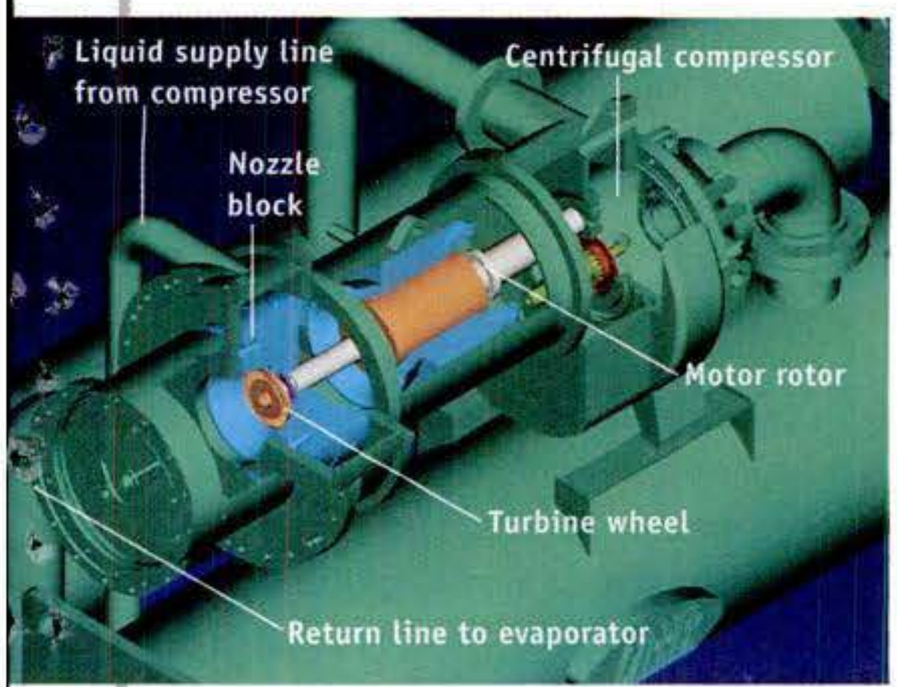
COOLING TECHNOLOGY

Efficiency Without Chlorine

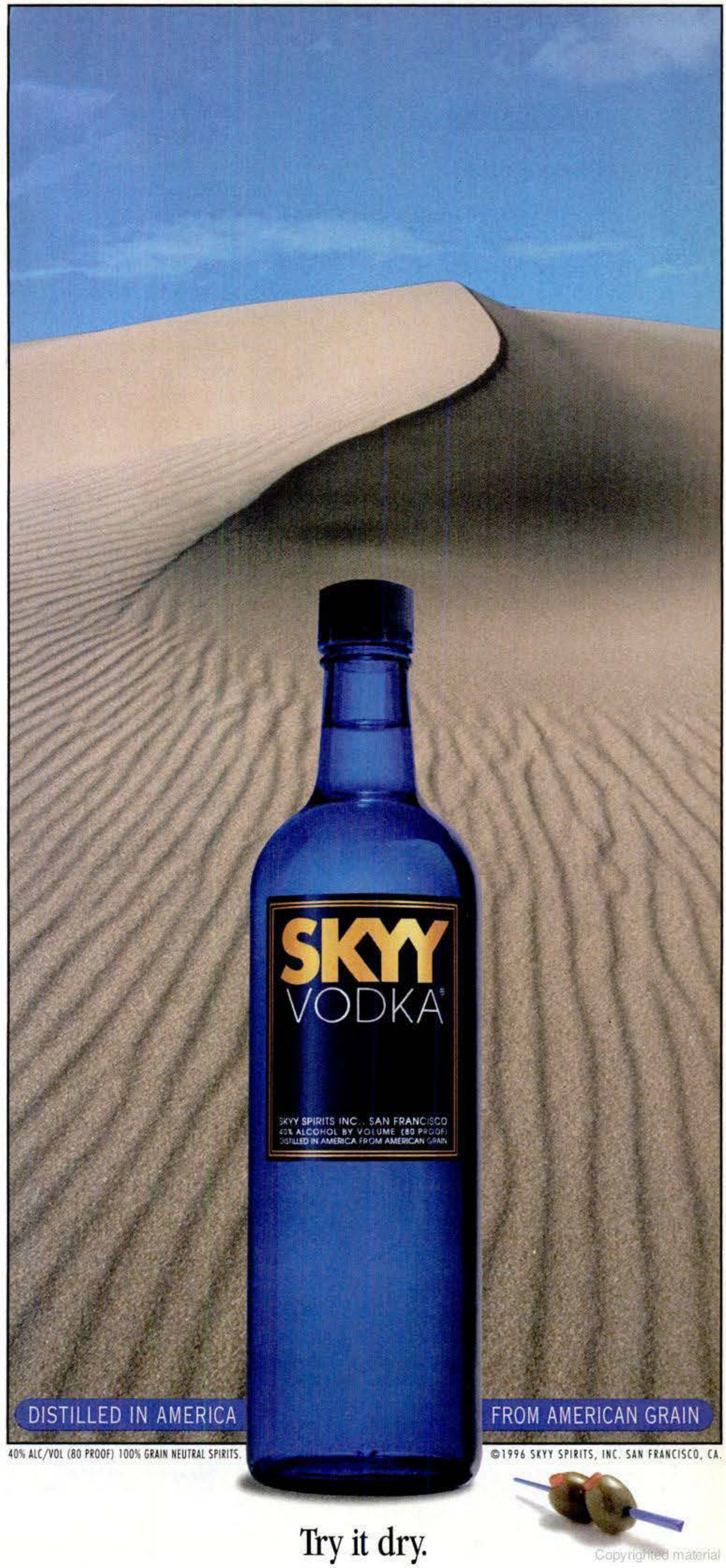
AS REFRIGERANTS made with ozone-damaging chlorine are phased out, manufacturers of commercial chillers for cooling buildings are switching to alternatives. But the chlorine-free refrigerants don't have the same chemical properties as the old ones, so the chillers that use them must consume more energy to produce the same amount of cooling.

To make up for the refrigerant, new chillers from Carrier Corp. of Syracuse, New York, rely on clever engineering. They use a unique turbine to capture energy that would normally be lost [see illustration]. As the refrigerant leaves the condenser, it flows through a nozzle that—somewhat like a Venturi tube—converts the pressurized refrigerant into a high-velocity vapor-and-liquid mixture. Rushing at about 200 feet per second, the refrigerant spins the turbine blades. This energy helps run the compressor motor, upping the chiller's efficiency by 5 to 8 percent, says Carrier engineer Joost Brasz.

The result is the first chlorine-free commercial chillers that operate as efficiently as conventional versions. Called Evergreen, the chillers use refrigerant 134a, which is also used in car air conditioners.
—*Judith Anne Gunther*



A new commercial-building chiller uses a turbocharger to improve efficiency.



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SPACE

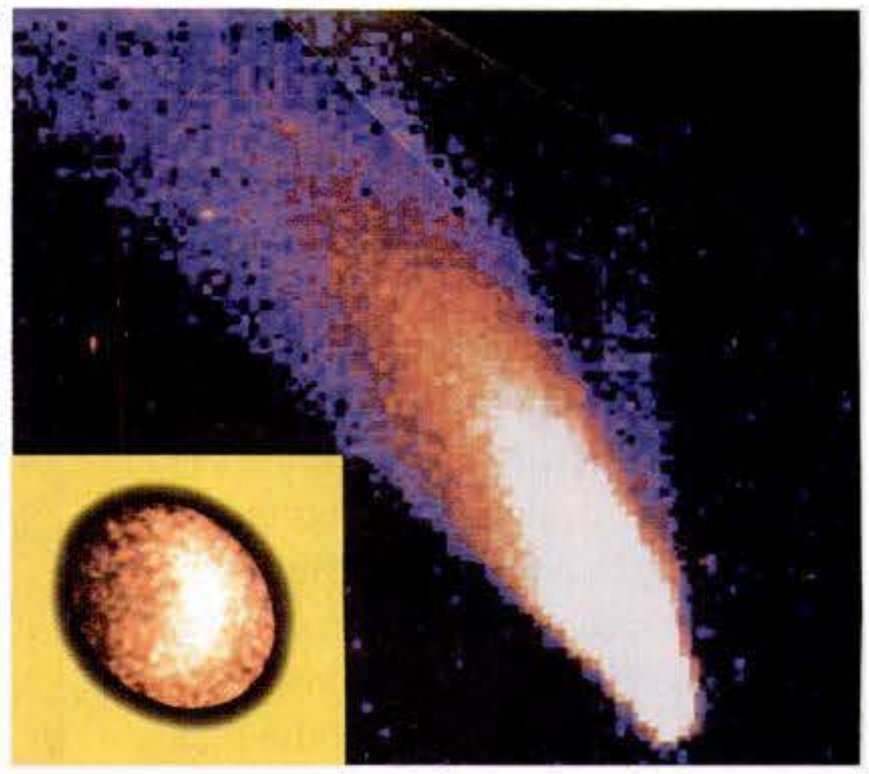
That Crazy Comet

NOT ONLY DID Comet Hyakutake light up the skies with a spectacular display a couple of months ago, it also lit up the eyes of scientists, who've concluded that the comet displayed peculiar, un-comet-like properties.

Such as? U.S. and German astrophysicists using Rosat, a German X-ray astronomy satellite, found the comet was emitting a crescent pattern of X rays from its nucleus. Comets, long considered balls of dust and ice, simply aren't supposed to do that. "We had no clear expectation that comets shine in X rays," says Michael J. Mumma of NASA's Goddard Space Flight Center in Greenbelt, Maryland.

One preliminary explanation is that X rays from the sun were absorbed by water molecules floating around the comet, and reemitted. Or the X rays may have been caused by the comet's collision with the supersonic solar "wind" of ionized gases and particles.

Chemical analyses revealed an even more dramatic surprise. A collaborative effort led by Mumma using NASA's Infrared Telescope Facility atop Mauna Kea, Hawaii, found ethane and methane in Hyakutake, compounds never before detected in a comet. Hyakutake may be the first of a previously unknown class of comets. Such ethane-containing comets may have formed in "warmer" areas of our primordial solar system, such as near the primitive Jupiter and Saturn; other comets might have formed farther away from the young sun, near the orbits of Uranus and Neptune. Comparing the Hyakutake data with those from other comets will help researchers evaluate this and other theories regarding Hyakutake's distinctiveness.—*M.D.*



X rays created the crescent in Comet Hyakutake's nucleus.

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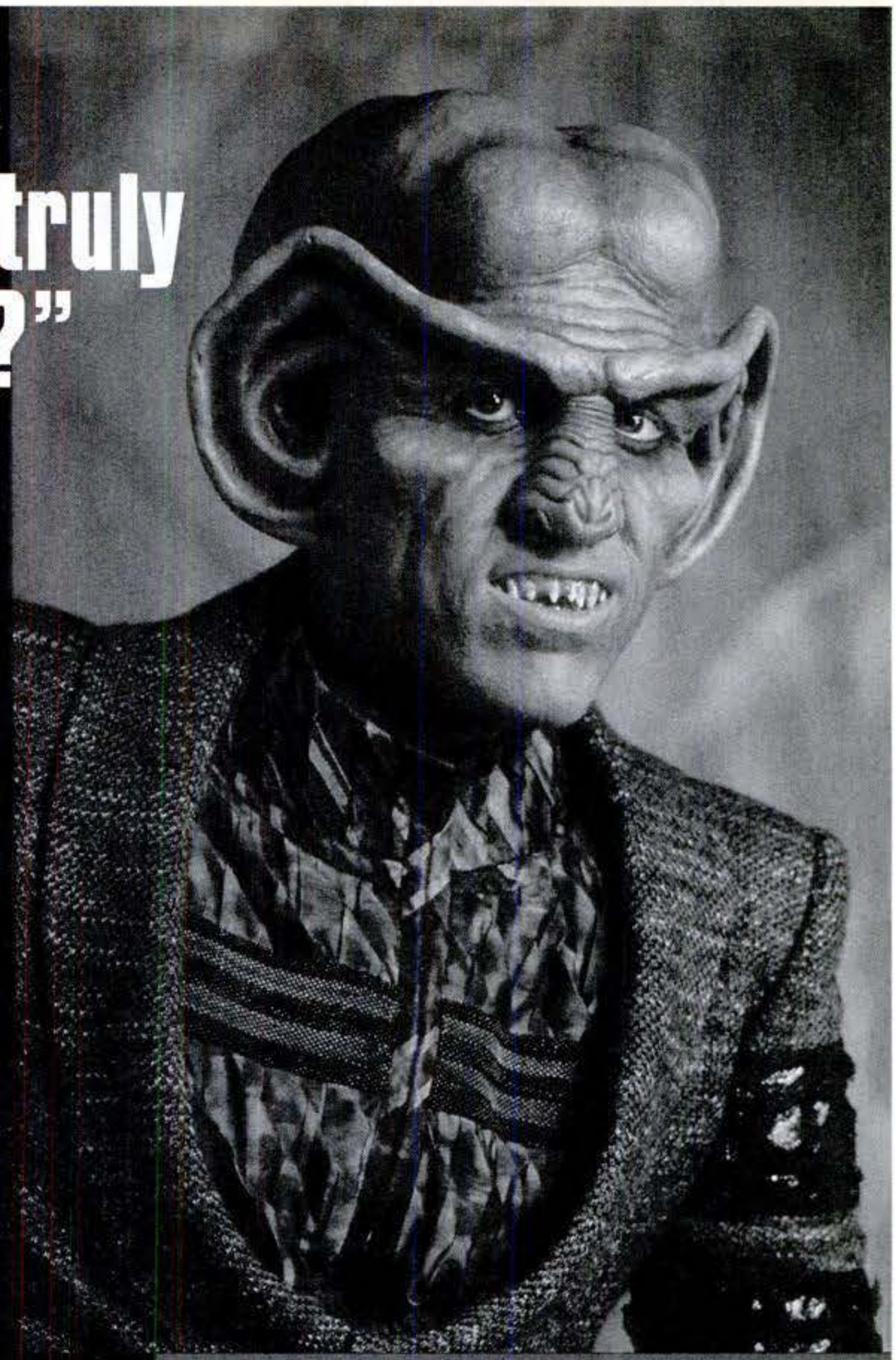

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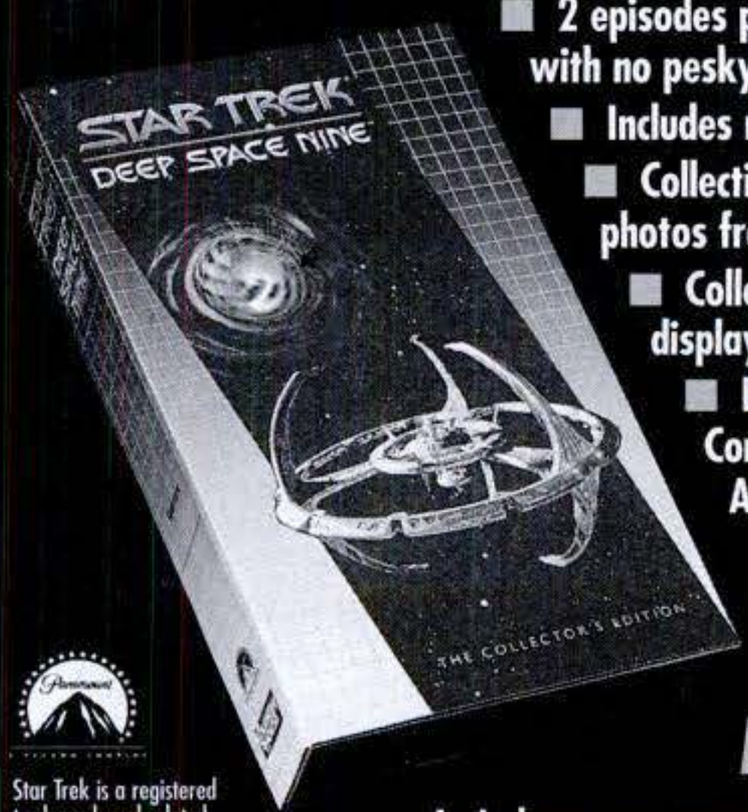

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AUTOMOTIVE

EDITED BY DAN McCOSH

ALTERNATIVE POWER

Fuel Cell in the Future?

DAIMLER-BENZ'S demonstration of a prototype minivan on the streets of Berlin served notice that the technology for clean, efficient fuel-cell power is poised to overcome one of its main obstacles: size.

Fuel cells produce electricity through the electrochemical reaction of hydrogen and oxygen—harmless steam puffs from the tailpipe [see illustration]. First conceived more than 100 years ago, fuel cells have been used by NASA in space applications, and some now even power commercial buses [see "Science & Technology Newsfront," April].

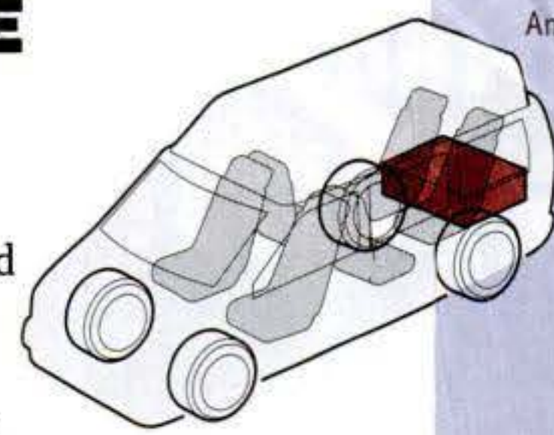
Daimler's Necar II, or New Electric Car, a joint effort with fuel-cell-maker Ballard Power Systems of Vancouver, Canada, is the first fuel-cell-powered vehicle to retain seating for all passengers. Necar I, introduced three years ago, required the entire minivan passenger area for its power system.

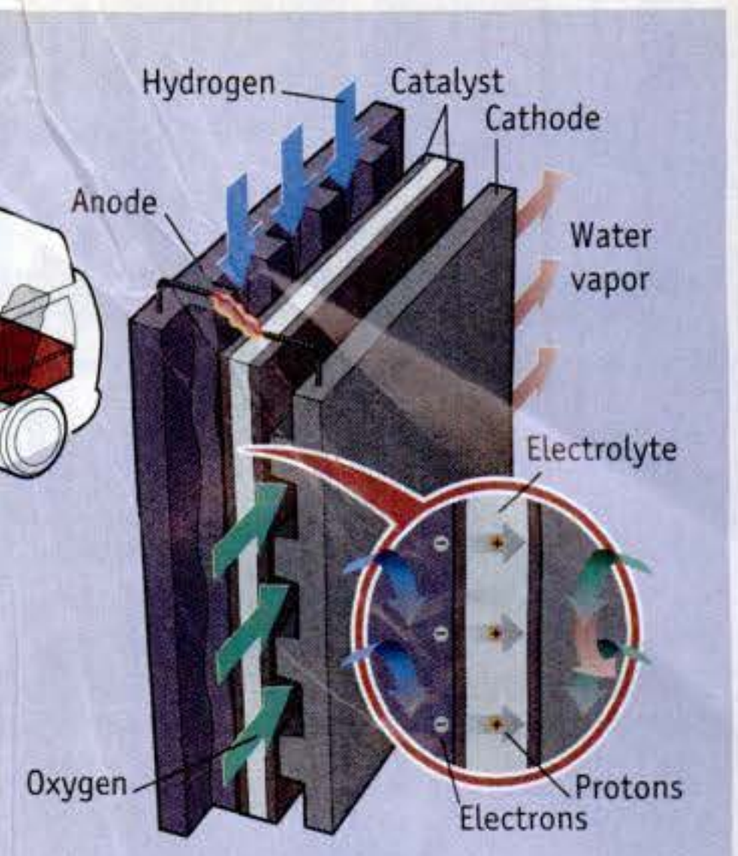
The power-to-weight ratio of the fuel cell was improved by a factor of five from the first Necar. The carbon plates used in each fuel cell were reduced from 1/4 inch wide to as little as 1/10 inch (they vary in size). Also, the configuration of the cells was altered, so they don't require heavy metal-containing plates on either end of the entire package. The overall savings meant Ballard could pack more energy into less space.

Necar II is based on the Mercedes V-class minivans, which will start selling in Europe in September. Its range is 150 miles (double that of Necar I), with a top speed exceeding 60 mph. Daimler-Benz will decide by the year 2000 whether or not to pursue commercial production, says president and CEO Helmut Werner.

Because today's technology is not yet in mass production, the eventual cost is difficult to estimate. But Ballard says studies have shown fuel cells could someday be cost competitive with today's automotive powerplants.

The prototype vehicle still has some kinks. At the Berlin test, our driver guided the van smoothly and silently away from the curb for a jaunt. Moments later, we heard a "whoosh!" and the van jolted to a halt with an ominous grinding noise. A faulty sensor misread the gear the motor was in. "You've probably heard that invention is 10 percent inspiration and 90 percent perspiration," Daimler-Benz R&D head Hartmut Weule said. "We've probably reached the hottest part of the perspiration phase." —*Mariette DiChristina*





GREG MAXSON

Power for the Necar II minivan comes from two stacks comprising 150 individual fuel cells.

1. Fuel-cell energy is translated directly into electricity by preventing hydrogen and oxygen from coming into direct contact by a separating layer, called an electrolyte.

2. Positively charged hydrogen ions (protons) travel through the electrolyte, while the electrons are left behind.

3. A negative charge accumulates on the hydrogen side, and a positive charge on the oxygen side. That creates the voltage to drive an electric motor.

ELECTRONICS

Safer Cadillacs

IT FEELS, IF YOU notice it at all, like a gentle hand pushing your skidding car back into control. Cadillac calls it "Integrated Chassis Control System with stability enhancement." It's an accident-avoidance system that piggybacks onto existing antilock braking technology to selectively apply left or right front wheel braking to correct a spin (oversteer) or plowing (understeer).

The system is one of several new applications Cadillac is exploring to enhance safety. Cadillac will offer it as standard equipment on all '97 models and the system will begin to spread to other GM divisions for 1998.

Another new system improves the effectiveness of antilock braking by adding road texture detection. On rough roads, tire traction is temporarily reduced as the wheels are bumped upward. ABS normally would decrease braking accordingly, lengthening stopping distances. With road texture detection, wheel sensors measure the vertical travel and a microprocessor assigns one of four roughness levels independently to each side of the car.

If you do get into an accident, the 1997 DeVille Concours will have side-impact airbags in the front doors.

And, finally, if any airbag inflates in a Cadillac equipped with the OnStar communication system, which is optional in all '97 Cadillacs, the car will place an emergency call to an OnStar operator.—*John Matras*

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PREVIEW DRIVE

Ford's Expedition Breaks New Ground

THE POWER AND packaging of Ford's new Expedition puts the emphasis on the "utility" part of the sport-utility equation. Although some elements are derivative—much of the chassis and some of the front-end sheet metal is salvaged from Ford's F-150 pickup—the result is far from a clone. This gives the Expedition distinction among the growing glut of high-priced sport utilities—many of them rebadged versions of existing vehicles.

It's a big truck. With a curb weight of 4,850 pounds, a 119-inch wheelbase, and a 4.6-liter, 215-horsepower V8 powerplant in the base model, the Expedition is solidly in Range Rover, Toyota Land Cruiser, and Chevrolet Tahoe territory. The seating, however, differs from the more or less evenly spaced three rows in these other vehicles. Instead, the Expedition merely pays lip service to a back row, with an optional, small rear jump seat suitable for a child. It's the cavernous center seat that catches your attention—a limousine-like bench, entered through rear doors suitable for a hangar. The rear seat is easily removable.

The Expedition uses a boxed frame to achieve chassis stiffness. The result is a solid ride, even when uneven surfaces twist the vehicle's body. The optional engine, a new 5.4-liter V8, delivers 230 hp. The larger engine still rates a respectable 13/17 city/highway EPA mileage rating with four-wheel drive. With the small engine and two-wheel drive, a 20-mpg highway rating is achieved. Both engines are overhead cam versions of Ford's modular V8 series.

The front, independent suspension is salvaged from the aforementioned F-150 pickup, but the coil springs at the rear are new. An option is a self-leveling rear air suspension with air shocks up front, which accommodates the weight of a trailer or a 2,000-pound payload. The Expedition has an 8,000-pound towing capacity.

The new chassis, engine, and suspension work in harmony on the road, offering a plush ride and responsive steering. The view from the cockpit is almost airplanelike, thanks to the seating height. Off road, the Expedition demonstrates a nimbleness that defies its bulk.—*D.M.*

Ford's Expedition is a roomy people and trailer hauler with an 8,000-pound towing capacity.

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ALTERNATIVE POWER

High-tech Patriot Dies

THE EFFORT TO put an advanced technology race car on the track has been postponed indefinitely by Chrysler. The Patriot, a turbine-powered car the company once hoped to run at Le Mans, has been shelved in favor of a less ambitious hybrid-drive car program that uses batteries.

Problems with the flywheel system, intended to store energy for bursts of power on acceleration, cannot be solved in the near future, says Chrysler. Also, the Patriot program was counting on the availability of ceramic turbine blades, but reliability problems with the blades have not been solved.

Chrysler says it ended up with some 60 patents on the car anyway, and the high-amperage electronic controls were successful—a key technology that can be applied to future electric-drive cars.

Chrysler is now the lead developer of hybrid-drive systems for the New Generation Vehicle program that is intended to develop an 80-mph family sedan.—*D.M.*

EMISSIONS

Two-Stage Catalyst

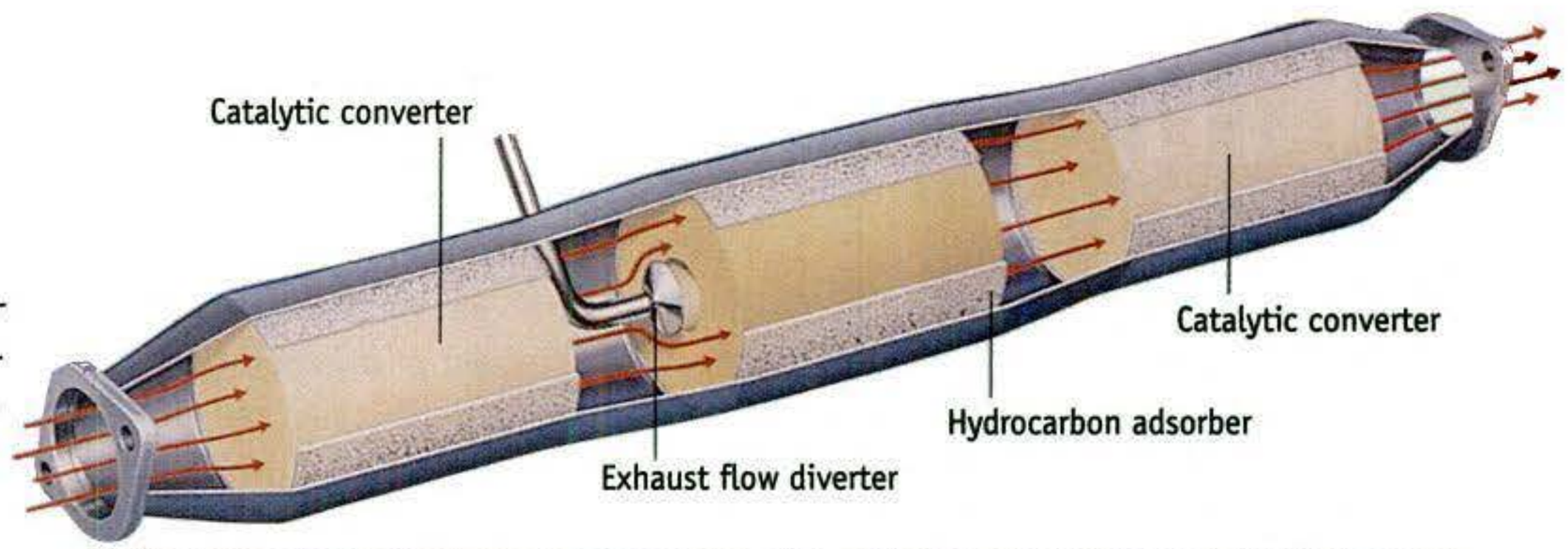
A NEW CATALYST that uses a zeolight adsorber has passed 100,000-mile durability tests, according to Corning. The combined system meets post-2000 ultralow-emissions vehicle requirements.

Zeolight is a porous metal that can trap and hold unburned hydrocarbons until the primary platinum catalytic materials reach operating temperature, according to Corning. The new catalyst positions the zeolight between two catalytic converters. An exhaust-flow management system diverts cold exhaust gases to the inline adsorber, which temporarily traps those gases.

The zeolight adsorber adds a new approach to emission control. The technology promises to allow a lean-burn catalyst in the future.

The new catalyst has no moving parts, which improves reliability; the catalyst begins reducing hydrocarbons immediately after ignition. In addition, Corning claims, its axial-flow design creates far less exhaust-restricting back pressure than that produced by other cold-start technologies, such as electrically heated catalysts and preconverters.

In recent tests with a 3.8-liter engine, the system achieved hydrocarbon emissions of .03 grams per mile, 88 percent less than the current mandated U.S. standard.—*D.M.*



Corning's two-stage catalyst is compact and durable, with technology that meets ULEV standards.

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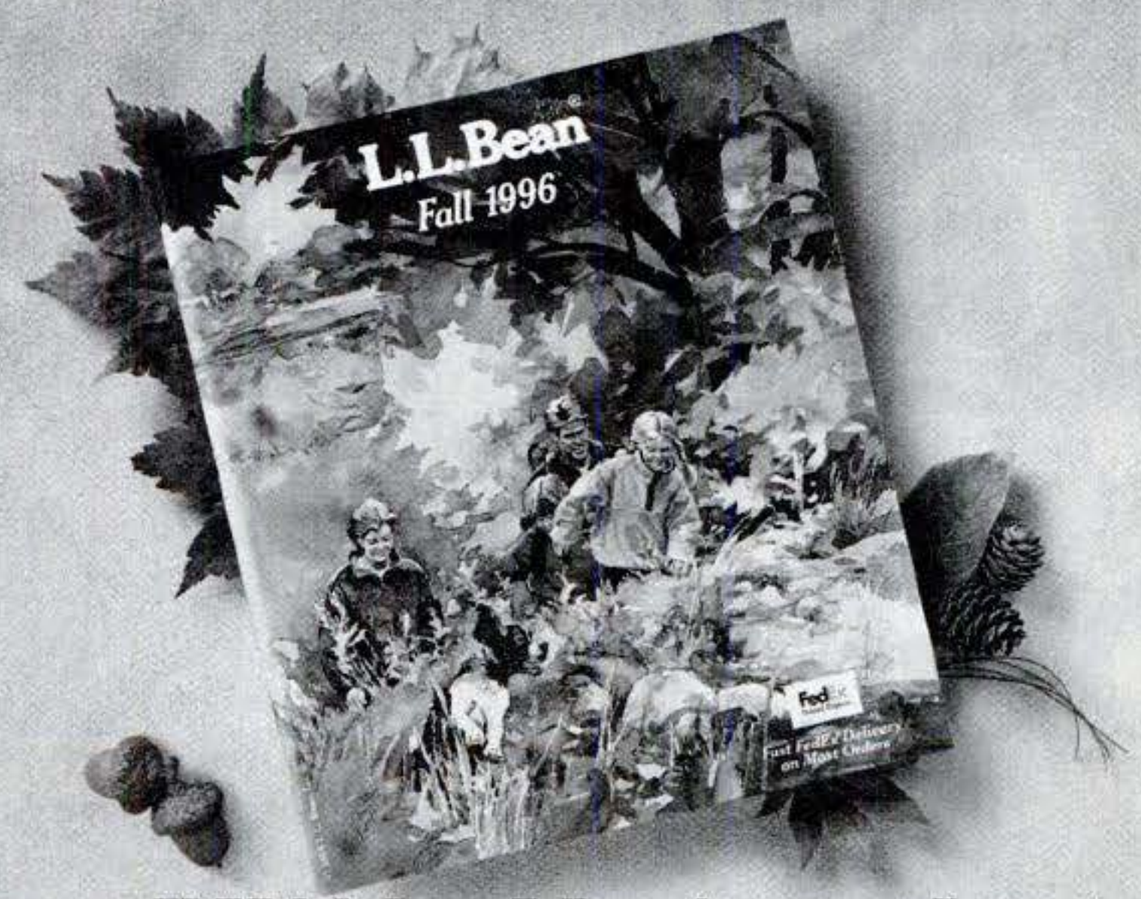

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1997 MODELS

Plush Pickup

Dakota: new body and improved handling.

DODGE'S 1997 Dakota is a slightly larger-than-normal compact truck, or a smallish full-size truck, depending on your point of view. The new in-between size is less popular than competitors in either category, however, even though the Dakota's weight specifications nearly match those of full-size quarter-ton vehicles, and its optional V8 engine isn't offered on compact trucks. The vehicle, which retains the 124-inch wheelbase from the 1996 model, is fine for personal transportation and hauling, although the bed does not accept a full sheet of plywood between the wheels. (But you can always prop the sheet above the wheel wells.) The truck still carries substantial loads and has a 6,800-pound towing capacity. These features, plus the V8 option, allow Chrysler to claim superiority in load hauling over all compact pickups.

The Dakota chassis has been fine-tuned so ride and handling approximate many compact sedans. In fact, the quick impression is that the Dakota delivers a smoother, quieter ride than the Dodge Neon. This was accomplished mainly through tuning and finessing, rather than by major suspension changes.

The interior has been freshened, and the wide front cab compares with many full-size trucks in shoulder, hip, and belly room. A third door is not available, however.—*D.M.*

PREVIEW DRIVE

Exotic Elegance

IF THE classically elegant lines of Aston Martin's DB7 Coupe and Volante convertible recall the company's DB5 and 6—legendary as James Bond's choice of wheels circa *Goldfinger* and *Thunderball*—it's no accident. Aston's new entries into the North American market aim to evoke revered former owner David Brown's marque.

Our test drive through Long Island's toney Hamptons showed a car capable of turning more than a few heads. The DB7's exotic looks, racy yet somehow subtly understated, drew a small crowd at the beach. Its ride was smooth and well-balanced, and the car responded nimbly in winding turns along the shoreline.

On the open road, the 335-horsepower, 3.2-liter DOHC supercharged 24-valve inline six-cylinder 3,239cc engine had power to spare. Top speed is rated at 160 mph and maximum torque is 361 foot-pounds at 3,000 rpm.

The 186-inch-long, 72-inch-wide chassis is steel with composite panels. The front and rear suspension is independent double wishbone with coil springs and antiroll bars. (Only the coupe has a rear antiroll bar).

The supercharged revolutions are there when you need them. Each gear on the five-speed manual has a wide range, so you can cruise comfortably in, say, third gear for quite a while. A four-speed automatic is optional. Aston tapped Ford's resources to help contain costs. But even at that, the Coupe is $125,000 and the Volante is $135,000.—*Bob Sillery*

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HOME TECHNOLOGY

EDITED BY JUDITH ANNE GUNTHER

INSULATION

The Sounds of Silence

AS HOME THEATERS and home offices begin sprouting up in the same houses, the conflict between the need for quiet and the desire to turn up the volume intensifies. Insulation manufacturers are responding with sound-dampening fiberglass products; how well these batts stop noise depends on how they are installed in interior walls.

Recently, Owens Corning rolled out its QuietZone Acoustic Batts, Schuller unveiled its plastic-wrapped ComfortTherm Sound Control product, and CertainTeed began offering its Quiet Home Package. All three resemble standard thermal batts and can be installed the standard way: by stuffing them between wall studs.

That method will block some noise, but not all. A wall with a sound transmission coefficient of 35, for example, will transmit a loud conversation. By adding acoustic batts, a homeowner can bump up the wall's coefficient to about 39. The higher a wall's coefficient, the better it is at stopping sound.

To further muffle noise, homeowners can use resilient channels, metal strips that hold the drywall away from the wood studs to break the path of the vibrations. Even adding a second layer of drywall helps. For example, an interior wall with batts, resilient channels on one side, and an extra layer of drywall on the other, yields a sound transmission coefficient of 52, through which only the loudest of sounds can be heard.—*J.A.G.*

Adding fiberglass insulation to interior walls can help bring peace and quiet to a house.

PAINT

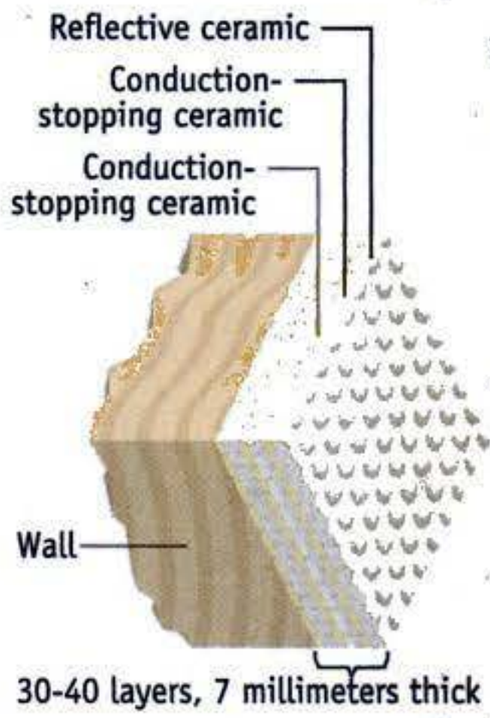
Liquid Insulation?

IF YOU WANTED to beef up your home's wall insulation, you probably wouldn't buy a can of paint for the job. But makers of radiation-control coatings—exterior paintlike compounds that contain tiny ceramic beads—claim their products can actually increase a home's R-value when used as an exterior coating. That's because the coatings are designed to reflect heat. So, they say, a house in a hot climate would better ward off the baking sun when coated. A seven-millimeter-thick coating (two to three times the thickness of paint) would add as much as R-19 to the walls' overall insulating value, producing the same effect as six to eight inches of fiberglass insulation.

Some observers are skeptical about these claims. Ned Nisson, editor of *Energy Design Update,* an industry newsletter, says the purported R-values cannot be substantiated.

Manufacturers concede these numbers are merely estimates. The R-value of paint cannot be measured directly, since the conventional testing method is geared to foams and mineral fibers. Instead, companies such as Ener-Save Technologies of Ajax, Ontario, arrive at R-values by using infrared cameras to show temperature differences of homes before and after they have been coated.

Research does indicate radiation-control coatings may reduce air-conditioning loads. Tom Petrie, a researcher at Oak Ridge National Laboratory, reports that the coatings are particularly effective on roofs, where they can lower surface temperatures and decrease heat flows into the building. However, Petrie says, the coatings do less for well-insulated roofs than for poorly insulated ones. "If your roof is well-insulated, you won't see much benefit," he says.—*Charles Wardell*



Particles in a coating reflect and block heat.

K. DANIEL CLARK

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Go Ahead and Skip the Furnace

WHAT IF YOU didn't buy a furnace for your new house, but instead applied the money saved toward extra wall insulation and energy-saving windows? Would that be enough to keep you warm through a Pennsylvania winter?

It would, says Gren Yuill, professor of architectural engineering at Penn State. Recently, he and graduate student Jim Rioux designed a 1,400-square-foot, furnace-free house that uses passive solar strategies, double walls, and a pared-down backup heating system to keep the house warm. What's more, the house cost no more to build than a conventional house.

When heat is needed, a small, two-kilowatt electric heater kicks on to warm incoming ventilation air. This air is then distributed throughout the house via miniature ducts —just 3½ inches in diameter—that are threaded through conventional two-by-four interior walls. "The air inlets are similar to those ventilation nozzles on airplanes," explains Yuill. Altogether, he estimates, this system circulates only about one-tenth the amount of air that most forced-air systems use.

To keep the heat inside, exterior walls are twice the thickness of normal walls, with a one-inch-thick slab of insulation in the middle.

As fresh air comes into the house, an equal amount is expelled to equalize the indoor air pressure. Before it leaves the house, the warm air is channeled through a heat exchanger, which transfers the heat to water for the domestic hot water supply.

Yuill estimates the house, which was designed in part with funds from the Department of Energy, should cost approximately $110 annually to heat.—*J.A.G.*

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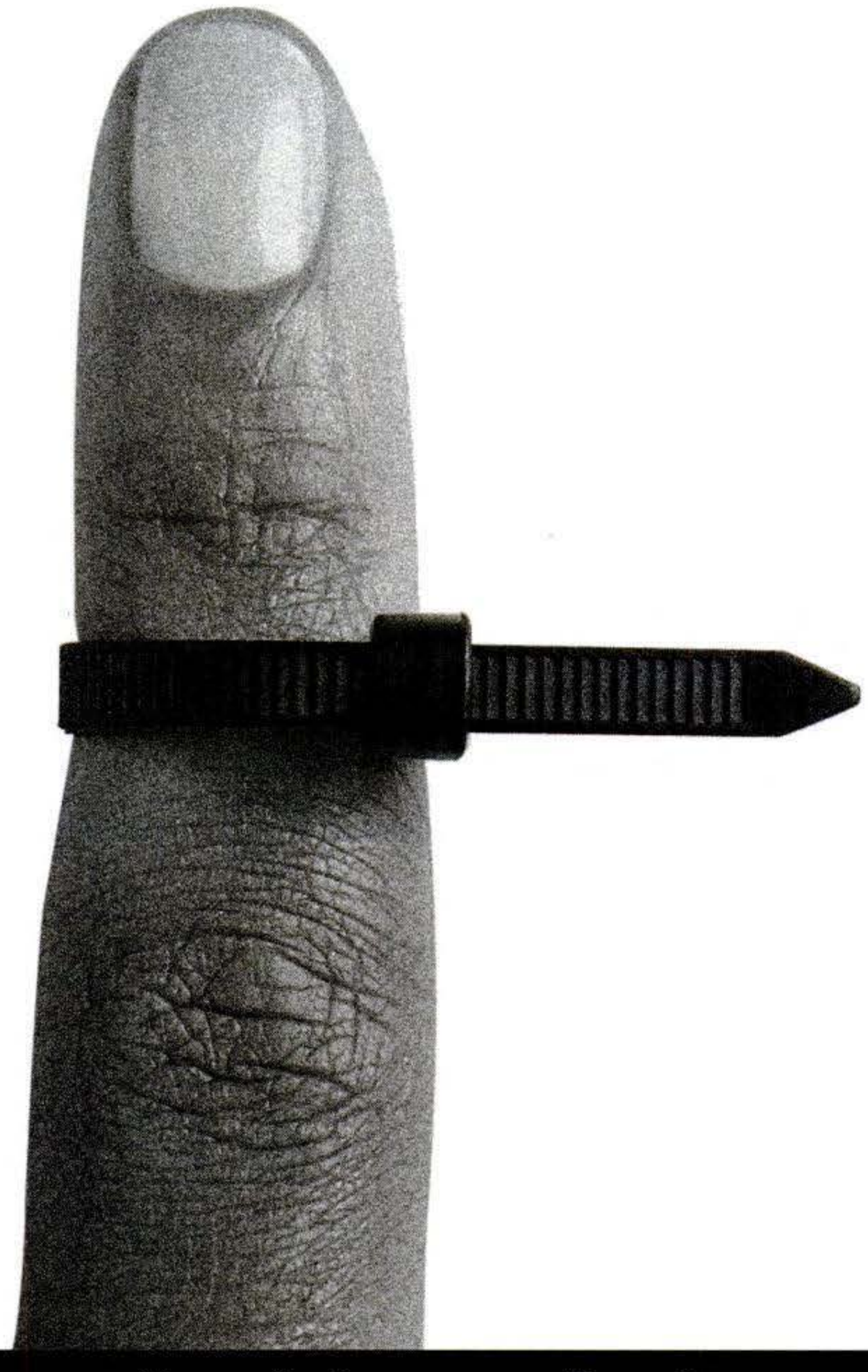

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HEATING AND COOLING

Heat Pumps Go High-rise

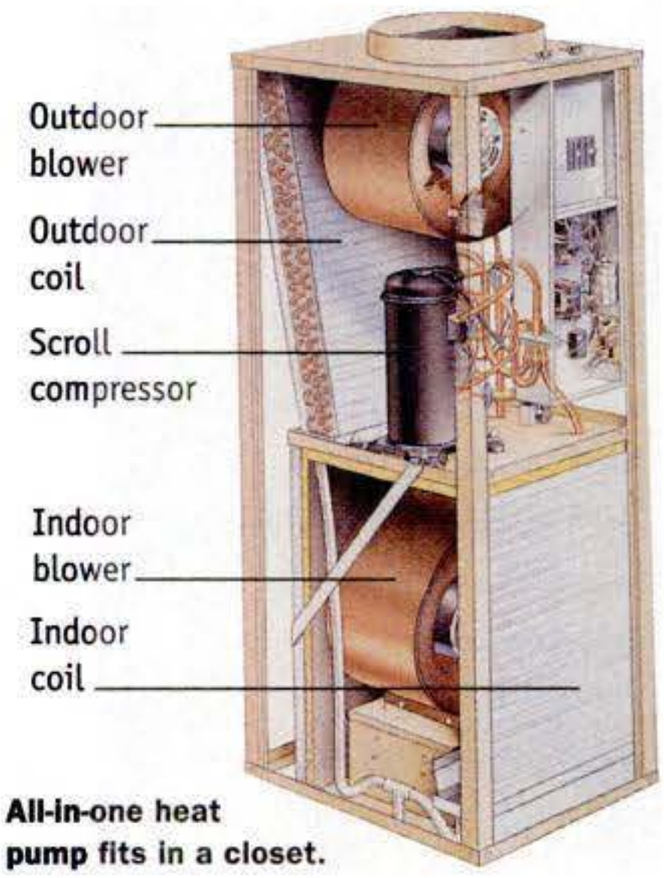
A HEAT PUMP, an energy-efficient heating and cooling system, isn't usually an option for condos and apartments. That's because heat pumps require an outdoor component to absorb or release heat to the air. Many multifamily buildings don't have a convenient place to put this component.

One company, Consolidated Technology Corp., does produce a residential heat pump called the Insider that fits entirely within a utility closet—no outdoor section is needed. However, past versions of the product were noisy, and suffered at times from some reliability problems. Now, the Electric Power Research Institute of Palo Alto, California, has helped improve the performance of the Insider, making it a more quiet and energy-smart option for multifamily dwellings.

The Insider draws in outside air through a duct, then blows it over a heat exchanger coil; inside the coil, refrigerant absorbs the fresh air's heat. The refrigerant is compressed, then circulated through a second coil. Indoor air moves across this coil, warms up, then flows back to the living spaces to heat them.

Because outdoor air must be blown in and out of the unit, the extra fan-power adds up to a small energy penalty compared to conventional heat pumps, says Terry Statt of EPRI. To compensate, EPRI borrowed proprietary airflow technology from the aerospace industry to develop a highly efficient fan. That helped to boost a prototype Insider unit from a Seasonal Energy Efficiency Rating (SEER) of 10 to SEER 12, which would make it the most efficient heat pump in its product class.

The SEER 12 unit should become available in 1997.—*J.A.G.*



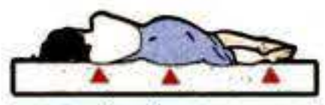
All-in-one heat pump fits in a closet.

"After three back surgeries...I thought I would never again have a good night's sleep. Thanks to Select Comfort, I can now look forward to going to bed."
—*Conrad H., Graham, TX*

Sleep Better On Air!

"I have had rheumatoid arthritis for the past 20 years. I was unable to put in a full night of comfortable sleep. I decided to purchase a Select Comfort, sight unseen. I am now able to sleep very comfortably 6-8 hours every night."
—*Eileen E., Canandaigua, NY*

SELECT COMFORT® sleep systems comfortably contour to your body, support your back and spine close to its natural alignment, and reduce pressure points.



Metal coil mattresses can create uncomfortable pressure points and provide uneven support over time.

The SELECT COMFORT® sleep system. It's not just a better mattress, but a better way to sleep. Even back pain sufferers can sleep more comfortably!

The Select Comfort Sleep System doesn't rely on springs or water, but on a cushion of air. Air gently contours to your body's shape, and tests show it helps support your spine close to its natural alignment.

The Mattress with Push Button Firmness Control!

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COMPUTERS & SOFTWARE

EDITED BY CHRIS O'MALLEY

HANDS ON

Spy vs. Computer

The spy thriller comes to CD-ROM with Spycraft.

SURE, YOU THINK the Cold War is over, but I know better. You with the agency? Good. Walk with me. And listen. There's an assassination plot underway that could wipe out this so-called Cold War peace. Using the same scientific tools that checked the bullet angle in the Kennedy assassination, I've been able to deduce some critical information. But I can't tell you any more right now.

OK, maybe just a bit more. I may feel like a CIA operative, but it's only the afterglow from playing Spycraft: The Great Game, a new $50 CD-ROM adventure from Activision. Created with help from the late William Colby (former CIA director) and Oleg Kalugin (former KGB major general), this is an engaging and realistic game that brings film noir spy thrillers and high-tech exploits to life.

You have access to high-tech tools such as satellite photos, secret radio transmissions, and much more to help you lead your special forces team. More than a hundred cinematic sequences add to the realism. You make the decisions on how to proceed, with choices becoming more difficult as the game progresses. If you're stuck—or make serious progress—you can dial up a direct link to the Spycraft Web and trade secrets with other operatives.

As with most games these days, this three-CD set works great with newer Windows 95 machines but may give you installation fits with older systems. Still, this is a well-crafted, exciting, and challenging game. So, Comrade, walk with me.
—*Jon Pepper*

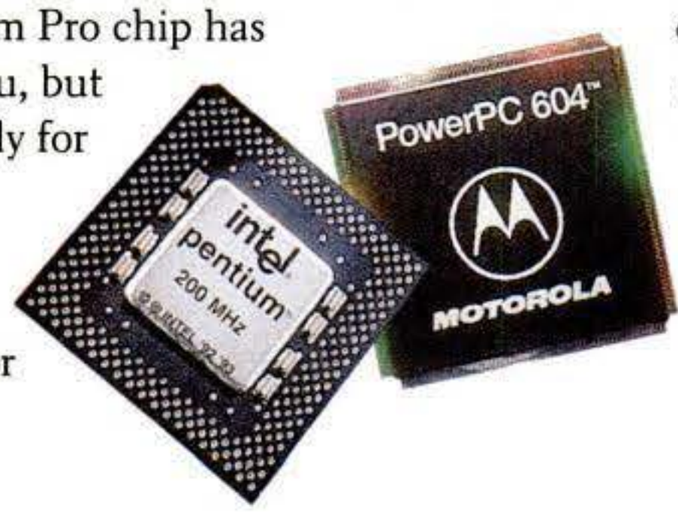
MICROPROCESSORS

The Chips Hit 200

DON'T LOOK for any bicentennial celebration, but the PC microprocessor is turning 200—megahertz, that is.

Intel recently introduced a new 200MHz version of its Pentium processor, which drives most Windows PCs. (Its Pentium Pro chip has already hit this plateau, but that chip is used mainly for network servers.) The first PCs using the new Pentium chip are slated for August or September, with many more arriving by year's end. In their wake, systems using the 166MHz, 150MHz, and 133MHz chips are expected to drop several hundred dollars in price.

The chips are flying on the Macintosh side as well. Motorola and IBM are producing two 200MHz versions of their PowerPC chip. The 200MHz PowerPC 603e and 604e chips are slated to appear in new Power Macintosh, Performa, Powerbook, and Mac-compatible models this fall.—*C.O.*



WEB WATCH

Our monthly filter of the Internet's World Wide Web.
(Addresses preceded by http://)

The Why Files
whyfiles.news.wisc.edu/
The whys of science answered.

Ask the Builder
www.askbuild.com
Home improvement online.

The Copper Page
www.copper.org
An elemental study.

Publishers Depot
www.publishersdepot.com
Pay-per-picture service.

TuneUp.com
www.tuneup.com
Hard disk maintenance.

Nuke
www.nuke.com
News and reviews for gamers.

The Big Book
www.bigbook.com
Yellow pages with maps.

Gamelan
www.gamelan.com
Java applets and news.

Ex-USSR Nuclear Technology
www.ida.net/users/pbmck/xsovnuc/graf_top.htm
The remaining nukes.

Wall Street City
www.wallstreetcity.com
Investment tips and tools.

NewsLinx
www.newslinx.com
Daily news for Webheads.

Metasys Gameland
www2.metasys.co.jp/
Live chess matches.

National Fraud Center
www.fraud.org
Scam alerts and postings.

New & Kewl
new-kewl.com
Gen-X lifestyles.

—*Suzanne Kantra Kirschner*

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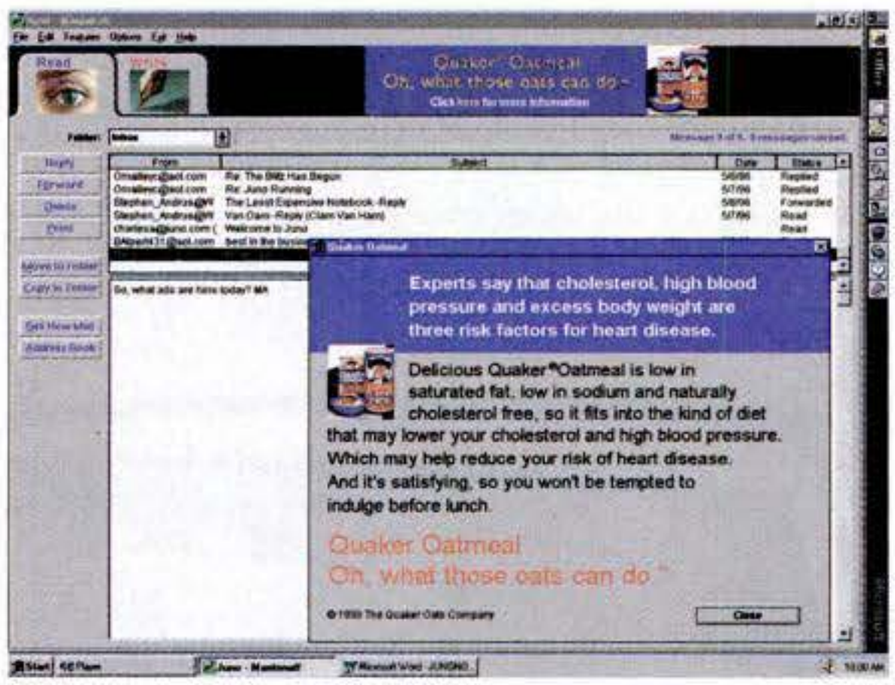
E-MAIL

Free Mail, with a Catch

THEY MAY SEEM like throwbacks to the earliest days of Prodigy—when ads for cans of Comet and Dole Pineapple streamed across the bottom of the screen—but ad-supported online services are here again. At least two companies are offering anyone a free e-mail service via the Internet in exchange for the opportunity to dump miniature billboards of advertising onto the screen.

Both Juno, from Juno Online Services in New York, and FreeMark Mail, from FreeMark Communications in Cambridge, Massachusetts, enable anyone with a Windows PC and a modem to dial up a local or 800 access number and then send or receive messages using the provided software. Messages are written and read off-line, and both let you create address books for regular e-mail correspondents. You can cut and paste text from your word processor, but neither service lets you attach a file (such as a picture) to a message. Since it operates via the Internet, you can exchange messages with subscriber services such as America Online or CompuServe.

Both services want some information for their generosity. Each requires that you fill out onscreen questionnaires about your interests, income level, and types of products you plan to purchase. Once you're connected, animated banners for Land's End catalogs, Miramax movies, and other items flash across your screen as you read and write messages. It's distracting, and much of the minute or so you're actually online is no doubt used for sending the ads. But you can't beat the price.—*Michael Antonoff*



You can't beat the price of e-mail services such as Juno, but you'll have to endure the hard sell for oatmeal, among other things.

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Tasco's fantastic new Lumina telescopes are out of this world. The larger 1.25" eyepieces are not only easier to look into but also engineered to give you a brighter, clearer view of the nighttime sky and one of the greatest sights of a lifetime. The Hale-Bopp Comet. It is being heralded as the greatest sky show since 1811!

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BEYOND HERE

Saying Yes to Decency

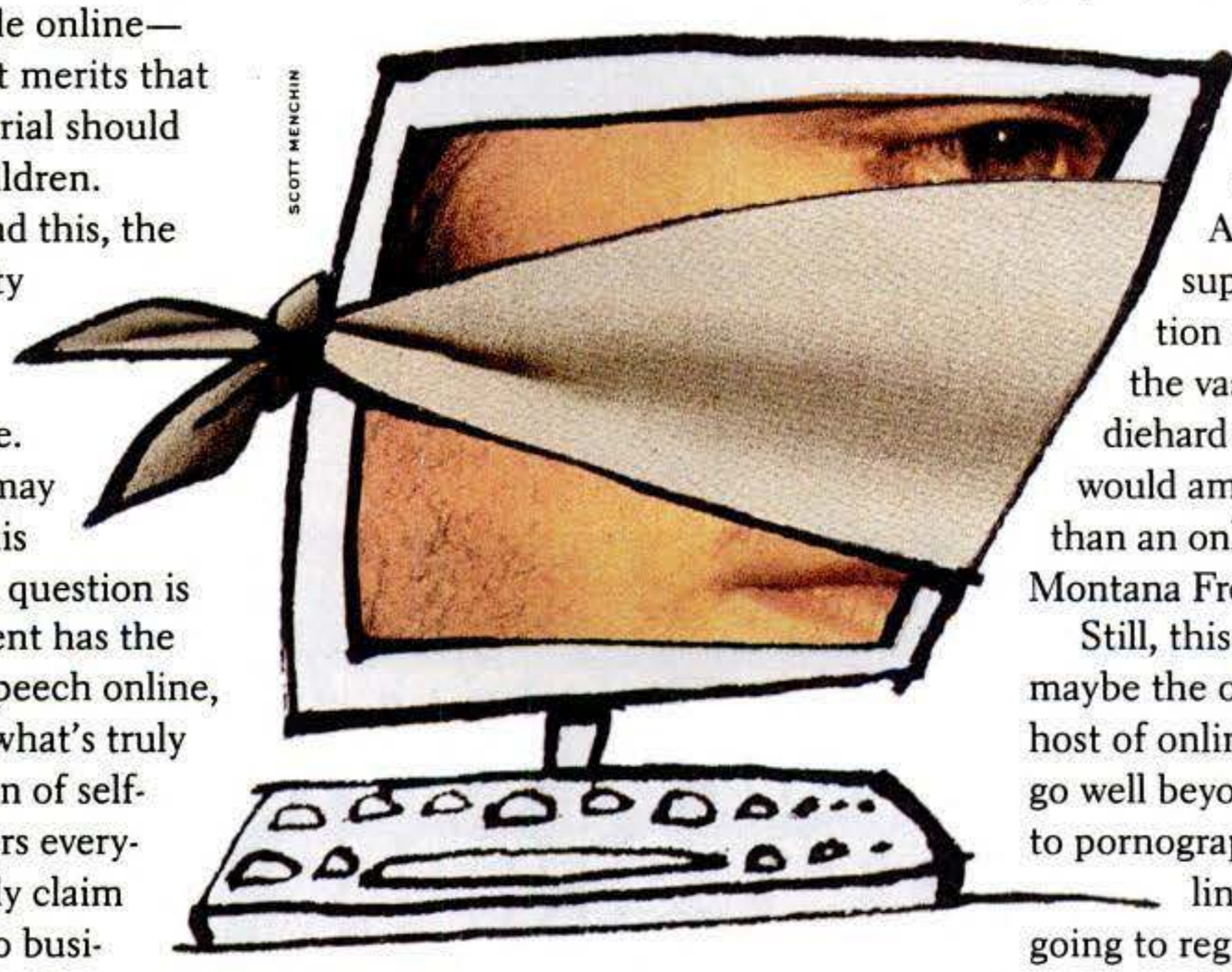
BY GINA SMITH

BY NOW, every journalist worth his or her laptop has come out against the so-called Communications Decency Act, or CDA. And for obvious reasons. This controversial provision in this year's landmark Telecommunications Act renders it a crime to make "indecent" material available online—without defining what merits that label or how the material should be kept away from children.

By the time you read this, the CDA's constitutionality will likely be the subject of heated Supreme Court debate. The short-term issue may be the vagueness of this act. But the long-term question is whether the government has the right to regulate any speech online, indecent or not. And what's truly indecent is the reaction of self-righteous Internet users everywhere, who indignantly claim the government has no business whatsoever getting involved with the Net.

Yes, it is absolutely true that the CDA, as drafted, is out of bounds in its scope and wording. As the act is phrased, for example, consenting adults cannot be sure their online conversations won't land them in jail. And you won't necessarily find any uniformity across different media. In a Philadelphia court this summer, government witnesses admitted that even something as newsstand-friendly as the infamous *Vanity Fair* cover featuring a pregnant and nude (but strategically covered) Demi Moore might be considered indecent under the act. And George Carlin's famous "seven dirty words" are definitely out.

The CDA is a bad solution. But it's a bad solution to a very *real* problem. CDA supporters are right when they say the Internet and online services are fertile playgrounds for pedophiles and other wackos bent on exploiting children. They're right when they say there's no place—on any medium—for nude pictures or videos of minors. They're right again when they say that telling parents to watch over their child's shoulder every minute is an unfair and impractical answer.



SCOTT MENCHIN

It's not the analog crowd that doesn't get it. It's the self-proclaimed online freedom fighters who don't.

The government has a right—even a responsibility—to protect children from hard-core pornography and pedophile harassment online. The question isn't whether, it's how. And that's the real problem: The Internet is a massive, borderless, international phenomenon. Even if the CDA holds up in court (and it won't), it is absolutely unenforceable.

So there needs to be another answer. A number of online blocking software programs are available, and they can help. But asking all parents—many of them far less technically astute than their kids—to find, install, and understand such programs is a flawed solution at best. The broader and more realistic answer, according to a growing number of voices, may lie within the Net community itself. Why not a virtual, worldwide governing body to police the Web and other areas?

Potential problems arise here, of course. Any governing body, from the United Nations on down, is only as effective as the consensus it builds, especially from the major players. And the major players (that is, the United States, Russia, China, Europe) often have very different sensibilities. And without sufficient support from the population at large (that would be the vast majority who aren't diehard netheads), such a body would amount to little more than an online chapter of the Montana Freemen.

Still, this is a good idea, and maybe the only real solution to a host of online growing pains that go well beyond children's access to pornography. Think about online commerce: Who is going to regulate the increasing number of national and international banking institutions on the Web? What about cross-border copyright issues? Online disputes? Privacy? Do we really want courtrooms across the world addressing (slowly) all these questions?

Only some form of Internet government will be able to deal with these issues. And it will happen.

Gina Smith appears regularly on "Good Morning America," and nightly as host of The Discovery Channel's "Cyberlife." Send comments to PSLetters@aol.com.

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LEARNING

Help with Hearing

PEOPLE WITH hearing impairments have to clear special hurdles when it comes to the basic communications skills most of us take for granted. But a growing number of software programs can help.

A comprehensive new Windows CD-ROM program called Foundations in Speech Perception ($750) can help children with hearing impairments improve their listening skills through a series of drills that use visual cues and real (not computer-synthesized) recorded voices. Designed for use at home by children ages 3 to 12, it can assist kids with moderate to profound hearing impairments. The program can be used alone or with IBM's four-year-old SpeechViewer II product, which helps children or adults learn to speak. Foundations is marketed by Cochlear Corp. (800-871-7674).

There are at least two CD-ROM resources for learning sign language, too. IVI Publishing (800-432-1332) sells a $35 disc called Sign Language for Everyone, which includes video clips of a person making the proper signs. American Sign Language Dictionary, a $70 program published by HarperCollins Interactive (800-424-6234), serves its titled purpose but also teaches signing and finger-spelling using video, illustrations, and games.

The Windows 95 operating system also has several new features aimed at making software easier to use for the hearing impaired. Its Show Sounds function, for example, instructs all programs to use closed caption-type displays.—*C.O.*

SCANNERS

Digital Snapshots

EASY SCANNING has long been one of those computing oxymorons, like paperless office or artificial intelligence. But a new breed of scanners with a more narrowly defined purpose may help change that.

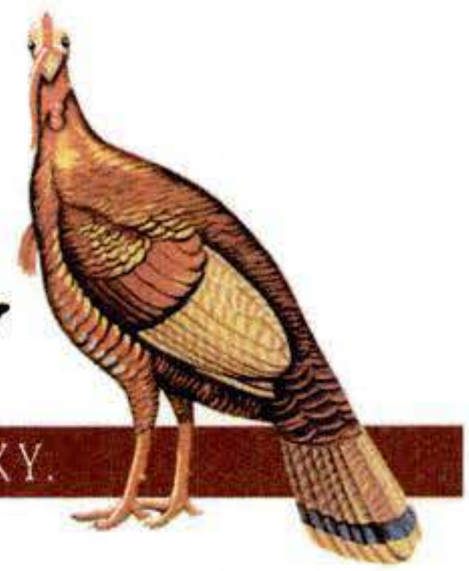
The latest in digitizing technology are compact photo scanners, typically designed to scan color or black-and-white snapshots and little else. That makes them less versatile than full-size scanners, but also less costly and complicated.

Epson's PhotoPlus ($249) plugs into your PC's parallel port and automatically crops and adjusts the image as it scans. The project-oriented software that accompanies PhotoPlus helps you create everything from calendars to refrigerator magnets with the scanned images. Polaroid offers a similar product called the Photopad ($299).

Photo scanners from Epson and Storm make it easy to share your memories online.

The easiest of all may be Storm's EasyPhoto Reader ($249), which automates all of the typical scanning decisions about image clarity and color. Storm now also sells a document-width version called the EasyPhoto SmartPage ($299). Logitech, Microtek, and others are expected to come out with photo scanning products of their own this fall.—*J.P.*

Too good to keep cooped up.



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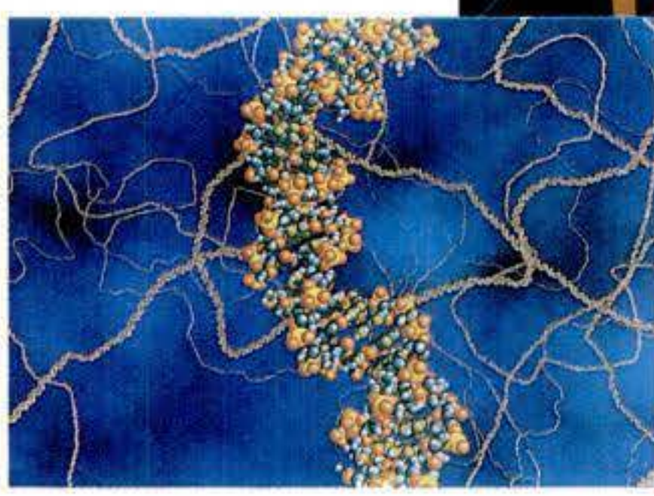
ELECTRONICS

EDITED BY FRANK VIZARD

MOVIES

Getting Inside Special Effects

Working in a virtual 3D space allows special-effects artists to create realistic images of molecular and stellar objects.



A NEW TOOL for creating breathtaking images gets movie special-effects wizards out from in front of a computer screen and into virtual reality. A software package called Virtual Director, used for the first time in an Imax film called *Cosmic Voyage*, puts the filmmaker inside the shot.

The special effects for *Cosmic Voyage* were created by an operator standing in a 10-foot cube-shaped room called a CAVE (Computer Assisted Virtual Environment). Stereographic video images were rear-projected on the walls, creating a fused three-dimensional image that seemed to hang in space and surround the operator. Using a 3-D tracking headset, the operator virtually navigated among the images, scaling them as desired—so, say, galaxies appeared to be light years apart or small enough to fit into the palm of a hand. Camera movement through the simulated environment was controlled through a magnetic tracking wand and a wireless microphone for voice commands.

The camera shots made inside the CAVE were then placed in another software program called Star Renderer that also was expressly developed for the making of *Cosmic Voyage*. Final processing of the film took place on a Silicon Graphics Power Challenge Array computer at the University of Illinois' National Center for Supercomputing Applications. The challenge was to convert more than 100 gigabytes of data—an unprecedented sum—into the same amount of imagery. The challenge was met, and viewers can travel to the outer reaches of space or into the smallest forms of life in one long continuous zoom.—*F.V.*

TELEVISION

Zenith's Secret TVs

ZENITH IS MAKING some new TVs, but the company doesn't want you to know it.

It sounds strange, but marketing geniuses being what they are, Zenith's new high-end TVs are being sold under the Inteq brand—the name being the sole legacy of a top-secret project Zenith did for the U.S. government. The only mention of Zenith is in small print in the owner's manual.

The Inteq line consists of 27-, 32-, and 35-inch direct-view models, as well as 52- and 60-inch rear-projection TVs. List prices range from $1,100 to $4,300.

What you get for your money is better performance. Zenith says the TVs are 29 percent brighter and offer roughly double the picture resolution, focus, and signal-to-noise ratio of typical televisions. The TVs do include existing picture-enhancing technologies, such as an Invar shadow mask to improve contrast, but the real difference is the inclusion of a digital three-line comb filter that makes the picture more lifelike by significantly reducing dot crawl and other picture distortions. Previously, digital three-line comb filters were available only in TVs with higher price tags.

Inteq TVs also have a few other technical extras not commonly found among the competition. One, called the BBE system, automatically compensates for the subtle distortions and loss of fidelity that occasionally occur in loudspeakers. Another is the Starsight Electronic News Service, a text-driven subscription service offering news, sports, and weather information. Also included is an additional tuner so you can watch a second channel in the picture-in-picture window.

Perhaps most interesting of all, the 35-inch model will have a built-in Internet browser and e-mail capabilities when it appears this fall. With as many as four front jacks and 16 rear jacks, the Inteq TVs are designed to be the centerpiece of a serious home entertainment system.—*F.V.*

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You'll notice a difference the first time you squeeze the handle. Starting with the fact that you can actually squeeze the handle.

Our new Sharpshooter™ staple gun takes only 19 pounds of force to drive a staple flush. (That's a third less than our leading competitor.) It also has an anti-jam staple core. And a patented double-bumper

system that helps reduce recoil and hand fatigue. This intense

attention to detail sets Stanley apart from other tool companies. It's what led us to design a garage door able to withstand a hurricane and a tape rule that's Mylar®-coated for durability. And it's something we're quite confident you'll notice every time you pick up one of our products.

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DISPLAYS

Wrist Pictures

THE NOTION OF a tiny wrist-sized color display is as old as Dick Tracy. Making one that's affordable has been an insurmountable problem that may now be licked.

Liquid crystal displays are a natural choice for tiny displays because of their inherent flatness. The problem is that adding a splash of color to LCDs measuring less than two inches diagonally is no small task. In tight quarters, making the connections between the pixels' color elements and the electronics controlling them is challenging.

Currently, a high-temperature process that allows the drive electronics to be installed directly onto the substrate itself is used, which eliminates interconnections. But the temperatures required are so high that they melt glass, so quartz, a more expensive material, is required. In other words, you pay by the pixel.

"Finding a way to do the same thing at a much lower temperature is the carrot on the stick we've all been chasing," says Joel Pollack, senior product manager for displays at Sharp Electronics, one of the dominant producers of LCDs.

Consider the carrot just about snagged. The procedure is proprietary, so no one's saying exactly what the trick is, but Sharp expects to launch a line of small, colorized LCDs at much lower cost than those currently available, by the end of the year. Other manufacturers are sure to be close behind.

Taking a different approach is a start-up company called Micro-Display in Berkeley, California. The company has developed a way to etch gratings directly onto the substrate; the gratings then pick out, and become saturated with, specific wavelengths of light.

"The downside is that the angle of viewing is very limited," says Philip Alvelda, who developed the process. "But the tradeoff is that we can put a high-resolution 2,000-by-2,000 pixel display in a square centimeter area without using any additional materials."

The displays will be designed for configurations where the angle of viewing doesn't change, such as in virtual reality headsets and handheld pagers. Alveda expects the displays to be on the market in early 1997.—*Jerry Shine*

SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, And May Complicate Pregnancy.
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CARLTON
SOFT PACK
CARLTON
CARLTON IS LOWEST
U.S. Gov't Test Method confirms of all king soft packs: Carlton is lowest in tar and nicotine.
Carlton is lowest
Kings: 1 mg. "tar", 0.1 mg. nicotine. Lowest of all brands: Carlton Ultra: less than 0.5 mg. "tar", less than 0.05 mg. nicotine av. per cigarette by FTC method.

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NAVIGATION

Cars That Talk You There

MORE THAN A FEW people are talking to their cars these days, but now their cars may be ready to talk back and tell them where to go—literally. A new navigation system that uses voice-recognition technology is now available under the Alpine, Clarion, Eclipse, and Kenwood brand names.

Developed by Amerigon of Monrovia, California, the Interactive Voice System is not speaker dependent, so you don't have to train the program to respond to your voice. You simply spell out one word in the street or landmark you plan to drive to, and the system audibly presents you with a choice of possible destinations. IVS then gives you directions, distance, and estimated time to your destination, which you can access as many times as you wish. Directions are stored in memory, so you can pop the navigation disc out of the CD player and play some tunes instead.

Discs are offered for individual metropolitan areas and hold 95,000 street names and 32,000 landmarks each. Also included are directions to restaurants, banks, golf courses, hotels, and other sites. One bit of information not included: the location of the nearest parking garage. IVS also has a quirky sense of priorities—for example, it will reference New York City's Empire Szechuan restaurant as a landmark before the Empire State Building

Prices for IVS vary depending upon the brand, but expect to pay around $600 for the basic setup. IVS may soon be offered by automakers as well, at which point you can expect it to be integrated with other onboard electronic systems. Expect also some IVS game discs that will let you play a rolling session of blackjack.—*F.V.*

IVS navigation requires a special car radio that can store directions in memory.

SURGEON GENERAL'S WARNING: Smoking Causes Lung Cancer, Heart Disease, Emphysema, And May Complicate Pregnancy.

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CARLTON MENTHOL
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CARLTON IS LOWEST

U.S. Gov't Test Method confirms of all Menthol king soft packs: Carlton is lowest in tar and nicotine.

Carlton is lowest

Kings: 1 mg. "tar", 0.1 mg. nicotine. Lowest of all brands: Carlton Ultra: less than 0.5 mg. "tar", less than 0.05 mg. nicotine av. per cigarette by FTC method.

Dinosaur hunter Paul Sereno demonstrates how easy it would have been for the meat-eating *Carcharodontosaurus* to devour a human, had they lived at the same time. The skull is 5 feet, 4 inches long.

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A 90-million-year-old giant has been unearthed by a globe-trotting paleontologist.

The Dinosaur Hunter

THE MOROCCAN SAHARA, 1,500 miles from anywhere. Paul Sereno strides purposefully over crumbly desert ground. He is hunting. Hunting for the ancient hunters.

The temperature has soared to 120°F during this expedition. Some of the nine team members have lost 20 pounds each in the brutal heat. A few have glued chunks of old tires to their worn boot soles. Most of the dinosaur fossils the team has found have been in frustrating fragments; sometimes weeks have passed without finding a single unbroken bone—just craters where the poachers have been digging. With the season drawing to a close, no major discoveries have been unearthed, no near-complete skeletons of the big predators.

By Mariette DiChristina

Gazing up at a sheer, 500-foot-high hillside of rock, Sereno spies patches of reddish sandstone—the sort that is often the final resting place for dinosaur bones. He scrambles for 20 minutes before reaching a softball-size bone that juts from the rock. "It was the back end of a skull," he later recalls. Was it the tip of the iceberg? Or was it just another one of those tantalizing bone fragments?

PHOTOGRAPHED BY JOHN B. CARNETT

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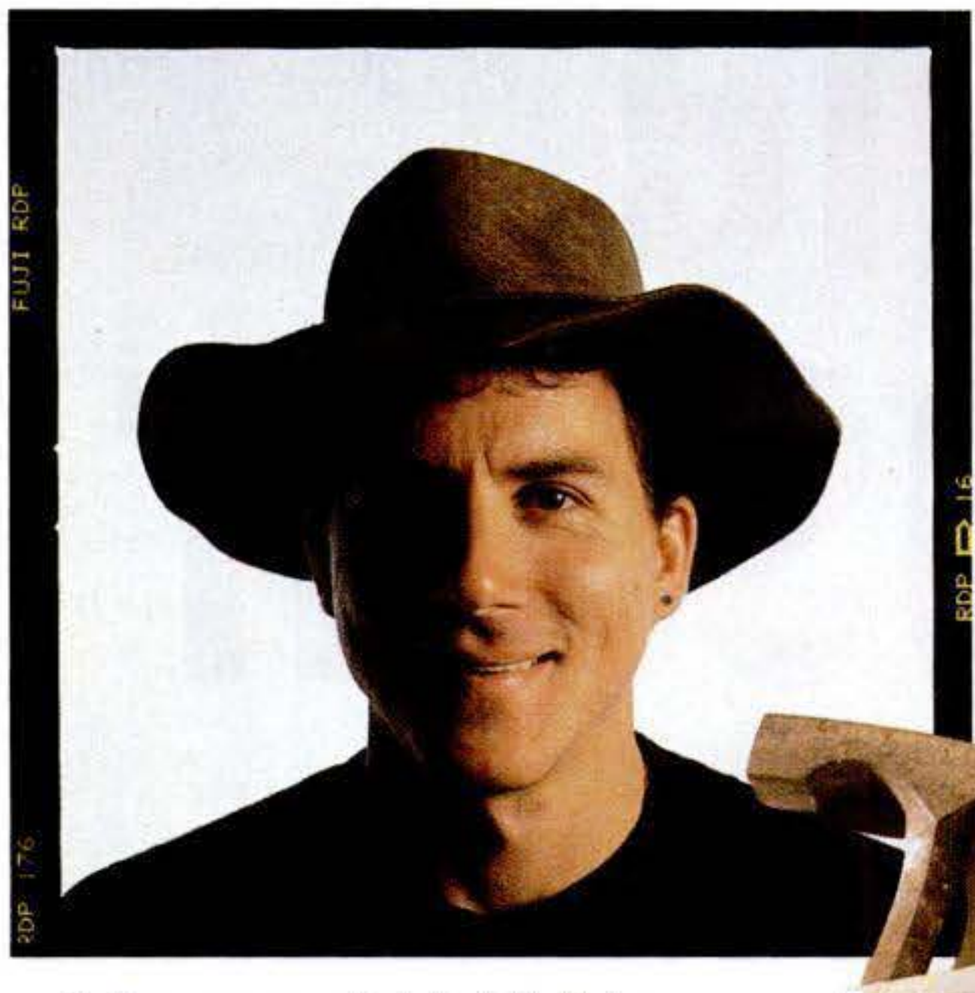
It turned out to be the tip of an iceberg, all right. A tremendous iceberg of rock and soil containing the fossilized bones of a gigantic meat-eating dinosaur, larger than any known specimen of the infamous *Tyrannosaurus rex*—the "king" of the carnivores. The newly unearthed monster is *Carcharodontosaurus saharicus*, or "shark-toothed reptile of the Sahara," a towering 50-foot-long predator that lived 90 million years ago in what was then a vast river delta flood plain.



A dinosaur prospector's tools include a hat for protection from the fierce Saharan sun, hammer, compass, log book, and even a jackhammer (not shown).

It wasn't the first spectacular dinosaur discovery for Paul C. Sereno, and it likely won't be his last. In a dazzling career spanning only a decade, the 38-year-old University of Chicago paleontologist has made important finds in South America, China, and elsewhere in Africa. The African finds are especially important because until Sereno began exploring the Dark Continent, few fossils had been collected there.

An inflatable plastic dinosaur outfitted with a hat greets visitors to Sereno's office at the department of organismal biology and anatomy, and children's tempera paintings of green dinosaurs decorate the space beside his assistant. Atop the five huge stacks of books around his office are fossil casts of animals, including a gaping saber-tooth tiger skull. Pacing around a large metal desk while he finishes a phone conversation, Sereno wears a no-nonsense black digital watch, khaki button-down camp shirt, jeans, a turquoise stud in his left ear, and around his neck a small camel-leather pouch containing good-luck herbs from Niger.

When he was younger, you probably wouldn't have picked Sereno as an obvious choice for paleontology, or science at all for that matter. He was full of mischief. "I was having a problem focusing my energy and attention," he admits. Even now, sitting with his hands tightly clasped, biceps protruding from rolled-up sleeves, and leg sometimes bouncing, he seems a cauldron of energy. "I think I found my way though art," he says. It's an interest inherited from his mother, an art teacher. (His father is a retired civil engineer and postman, and a lifelong "closet scientist" whose interest in his children's work—all six are scientists—even extends to critiques of their research papers.)

At Northern Illinois University in De Kalb, Sereno studied biology and studio art. But dinosaurs must have been preying on his subconscious. As he built his art portfolio, he abandoned brushes for rags, seeking a more primitive style. Bones protruded from portraits that were supposed to be of live subjects. Sereno's canvases grew to 15 feet, and he formed rock-like shapes on them with plaster. When his brother took a course at the American Museum of Natural History, Sereno followed him to New York and discovered his true calling.

Since then, Sereno has been responsible for some of paleontology's most exciting finds. On an expedition to Africa two years ago, he discovered a new predator called *Afrovenator* and a 60-foot-long sauropod (a plant-eating dinosaur) that has not yet

"So much is going on in these be encyclopedic in your knowledge. them upside down

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been named. In South America, he dug up some of the oldest known dinosaurs, *Herreresaurus* and *Eoraptor*. As the first American graduate student in China in decades, he combed through bone archives to identify two new species of parrot-beaked dinosaurs.

"I particularly enjoy the combination of things that paleontology has to offer, from adventure and travel to a combination of different sciences to graphic illustration and even sculpting to recreate these animals," he says.

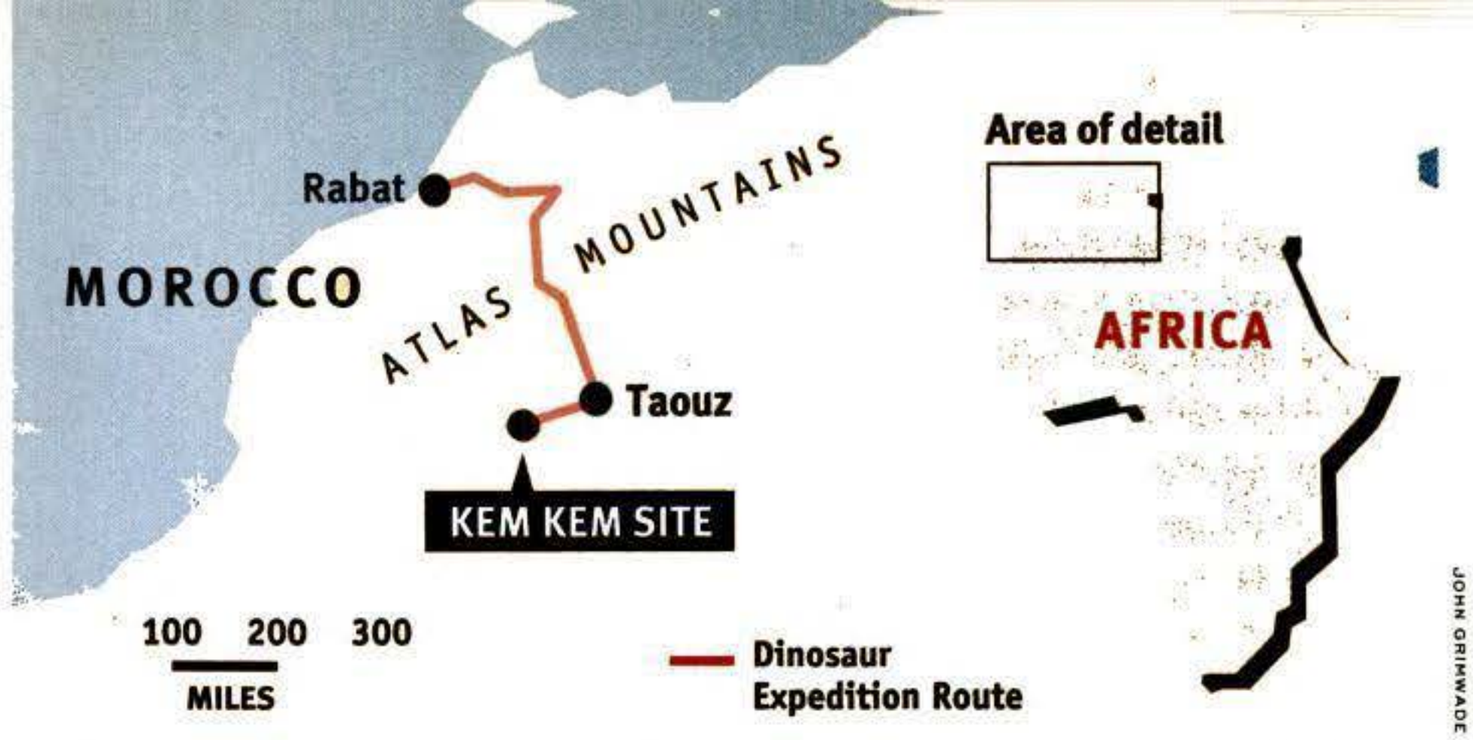
But for Sereno, the goal of all these activities is the same: fitting pieces into Earth's evolutionary puzzle.

Carcharodontosaurus is an important new piece. Another came later during the same Moroccan expedition.

bones. You've got to
You've got to know
and backward."

Team member Gabrielle Lyon, hobbled one day because she had to replace a wet boot with a sandal, took an easier route down a rocky hillside and saw the shine of crystallized marrow on bones protruding from the ground.

After a dinner fashioned from dehydrated food and spices back at camp, Sereno began fiddling with the bones



JOHN GRIMWADE

In today's desert, the remains of an ancient river delta are fertile dinosaur-hunting grounds.

Lyon had found. At first, he thought they might belong to *Spinosaurus*, a sail-backed oddity so far found only in Egypt. But when he turned one of the bones, he suddenly recognized it as the shoulder blade of a carnivore: The team had found an entirely new predator.

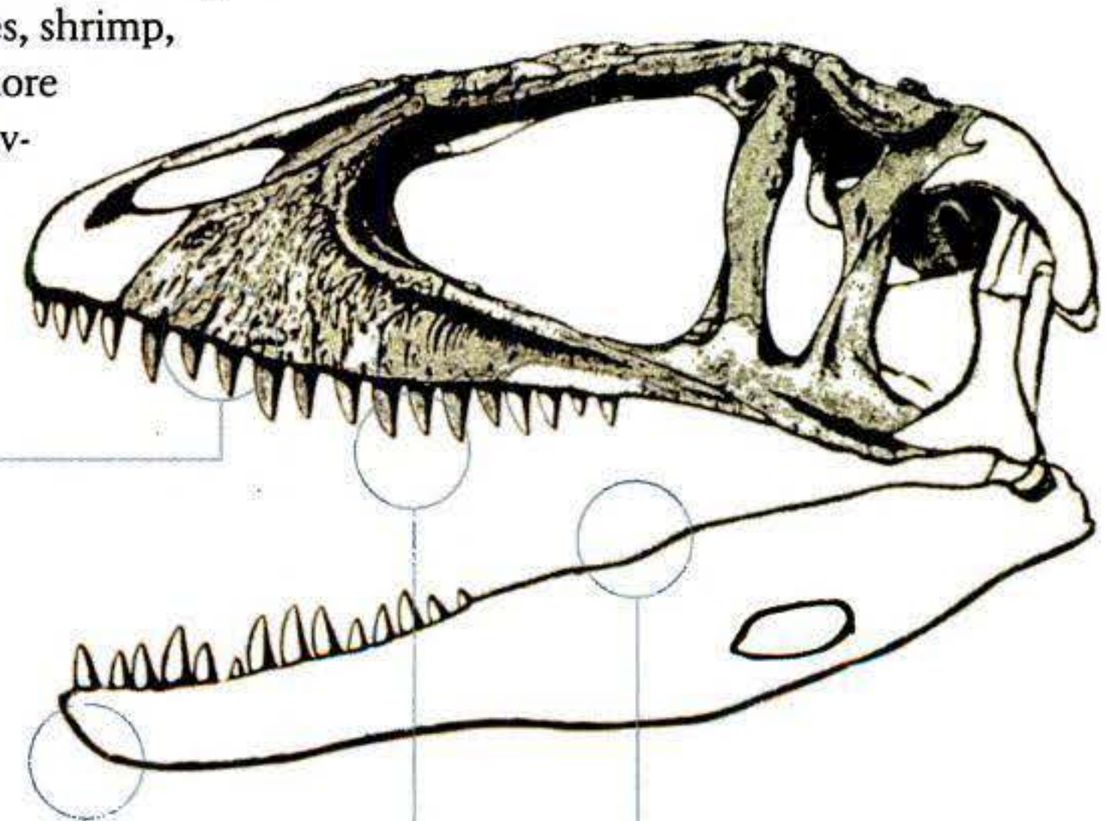
They named it *Deltadromeus agilis*, for "agile delta runner." Some 30 feet long, it had the slender limbs that mark it as a fleet-footed carnivore, with strong front arms for grasping its victims. The expedition team never found the dinosaur's skull, even after pounding the rock with a jackhammer. Ancient rivers long ago washed away many of the bones in the area, sometimes carrying them as far as 100 miles before depositing them. As a result, says Sereno, "Our first, most complete specimen was a crab [preserved in a single rock]." Then came turtles, shrimp, crocodiles, fish, frogs—more than 50 species in all, several of them unknown to science.

Finding a new species is exciting. But to Sereno, that pales in comparison with discovering how a species fits into the big picture of evolution. "A lot of people think that naming a new species is absolutely the most important thing," he says. "It's really not, because you can name a new species on the basis of a tooth that looks unusual."

Sereno did not give *Carcharodontosaurus* its name. A specimen was found earlier this century in Egypt, but in a sad twist of fate, the fossils were sent to Germany for study and were destroyed during World War II—though some descriptions survived. So *Carcharodontosaurus* was largely unknown until Sereno found his "iceberg" in Morocco last year. Determining

How to Get a Head

FINDING BONES IS just one step in deciphering a dinosaur. Until the bones (or replicas of them) are assembled into a three-dimensional structure, it's difficult to tell how the dinosaur looked. To make sense of their *Carcharodontosaurus* bone collection, Paul Sereno and two graduate assistants spent five 18-hour days building a skull in a Toronto studio. They used heavy plastic, foam, epoxy putty, welded pieces, and wire to create the model, which was then cast in lightweight plastic. Says Sereno: "I think it's a good estimate."—*M.D.*



To shape the skull, the team welded casts of the actual bones to a metal frame. Where they had a bone from only one side of the skull, they copied it for the other side.

Missing parts were fabricated from epoxy putty and carved foam. The whole structure was then covered with epoxy putty.

To preserve the original fossils, only one real tooth was cast; the rest were duplicated from the cast and fitted into the model's jaw.

Once the upper skull was assembled, the length of the lower jaw became obvious. For the jaw's shape, the team took its cues from the dinosaur's closest known relatives.

CAROL ABRACZINSKAS AND PAUL SERENO

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the exact identity of the dinosaur required months of study. And even now, scientists still have much to learn from the new bones, which offer many clues about the dinosaur family tree.

When dinosaurs first appeared some 230 million years ago, Earth's land masses were joined in one supercontinent, called Pangaea. All the dinosaurs were free to range across this supercontinent. Some 80 million years later, Pangaea split into two great continents: Laurasia and Gondwana. Scientists have long believed that dinosaurs evolved into distinct northern and southern subgroups after the breakup of Pangaea.

But it didn't happen that neatly, Sereno's Moroccan finds indicate. His dinosaurs are related to others discovered on what had, by that time, become a distant, separate continent. Somehow dinosaurs continued to migrate between the two continents, perhaps over a string of islands like those across today's Bering Sea [see illustration]. One of the dinosaurs that apparently made the crossing was the precursor to *Carcharodontosaurus*.

In *Carcharodontosaurus*, Sereno says, "we see something that arose from an entirely different evolutionary line [than *Tyrannosaurus rex*] and reached at least the same size, or greater, at about the same time *Tyrannosaurus* was getting a foothold in North America."

In North America, the line that led to *Carcharodontosaurus* never became the dominant predator, and was replaced by *Tyrannosaurus*. "We don't know why," says Sereno.

Carcharodontosaurus is related to the behemoth found last September in Argentina, *Giganotosaurus carolinii*. But it is even more similar to *Acrocanthosaurus atokensis*, which lived in North America. The African giant couldn't possibly be so closely related to these American dinosaurs had there not been a link between Laurasia and Gondwana for millions of years after they began to split apart. Further proof of this link: *Deltadromeus* is a distant survivor of the line that became *Tyrannosaurus* in North America.

In addition to telling part of the evolutionary story, dinosaur bones can provide clues about how big these animals grew, and how they behaved. Perhaps it's no coincidence, Sereno says, that the three largest known terrestrial predators—*Tyrannosaurus* in North America, *Giganotosaurus* in South America, and *Carcharodontosaurus* in Africa—were close in size. "There may be a set size limit for these predators."

Whatever their size, even the largest dinosaurs were not invincible. There are, for instance, marks of terrible injuries on the giant *Carcharodontosaurus* skull. The beast suffered a nasty blow to the side of its cheek. "It may have got that while it was preying upon something very large, which it undoubtedly did," says Sereno. The skull also has a deep tooth puncture above the left nostril. That could have happened during a fight with a rival.

To study the skull in detail, Sereno and his colleagues moved hundreds of pounds of rock, and wrapped the bones in foil and plaster-dipped burlap.

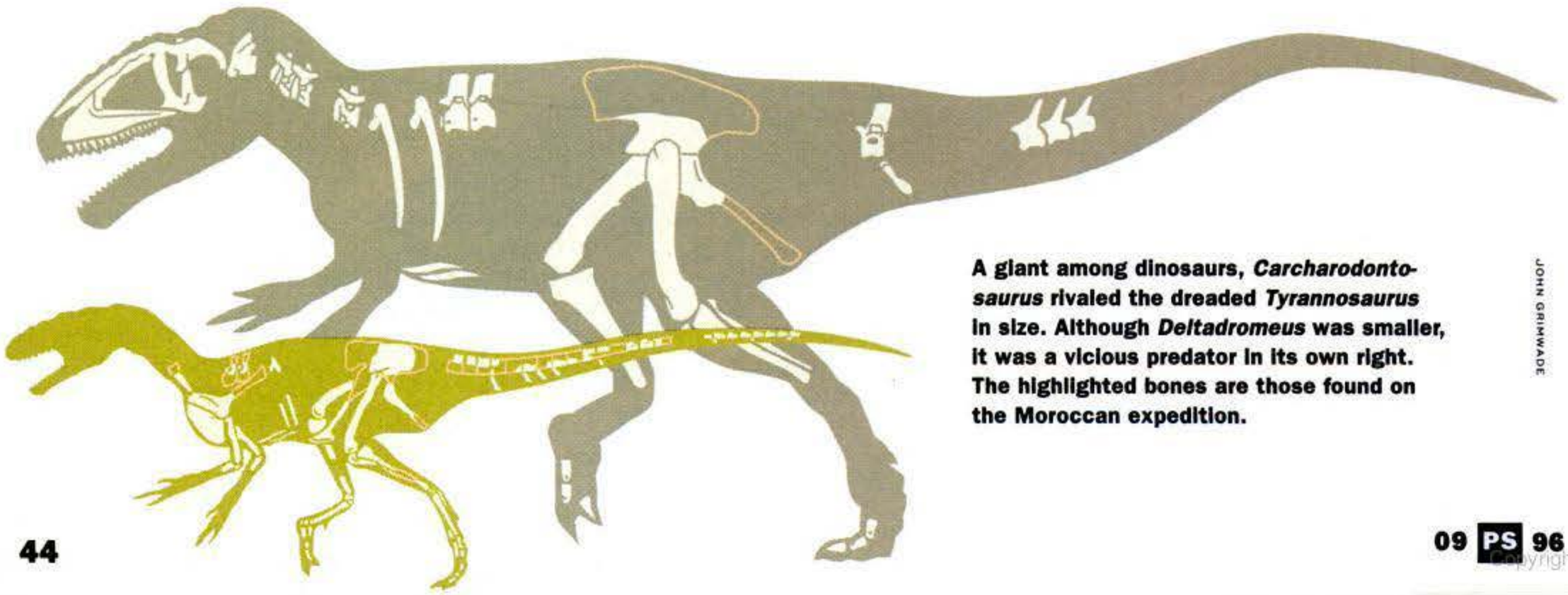
"It's a massive detective story. You've got little pieces, and they're spread around the globe."

Four team members hauled the 300-pound braincase and snout down the steep incline; they also collected 400 smaller pieces of the skull.

The bones were brought back to Chicago for further study. In the lab that adjoins Sereno's office, fossils rest on sand in boxes everywhere. There are long *Afrovenator* arm bones, discovered on a 1993 expedition to Niger. There are sauropod toe bones the size of a human forearm. A small box is labeled "good things." Team members Didier Dutheil and Mohamed Iarochene are studying tiny specimens with microscopes.

With a smile, Dutheil offers a prize to hold: a *Carcharodontosaurus* tooth. It sits heavily, extending for the length of my hand. Tinted by the

In the last era of the dinosaurs, fleet-footed *Deltadromeus* chomps on a hapless crocodile while *Carcharodontosaurus* stomps through the delta (opposite page).



A giant among dinosaurs, *Carcharodontosaurus* rivaled the dreaded *Tyrannosaurus* in size. Although *Deltadromeus* was smaller, it was a vicious predator in its own right. The highlighted bones are those found on the Moroccan expedition.

JOHN GRIMWADE

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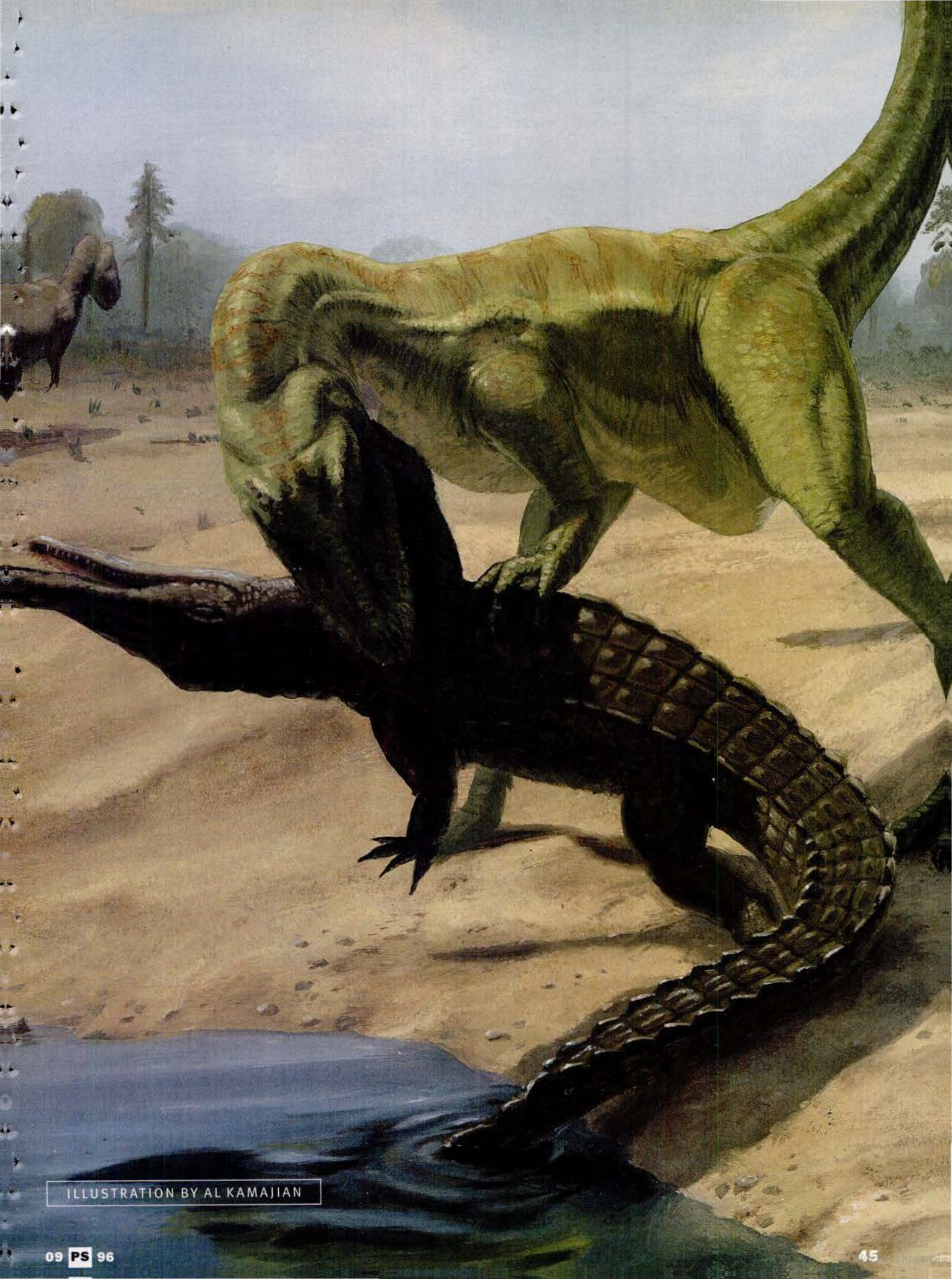
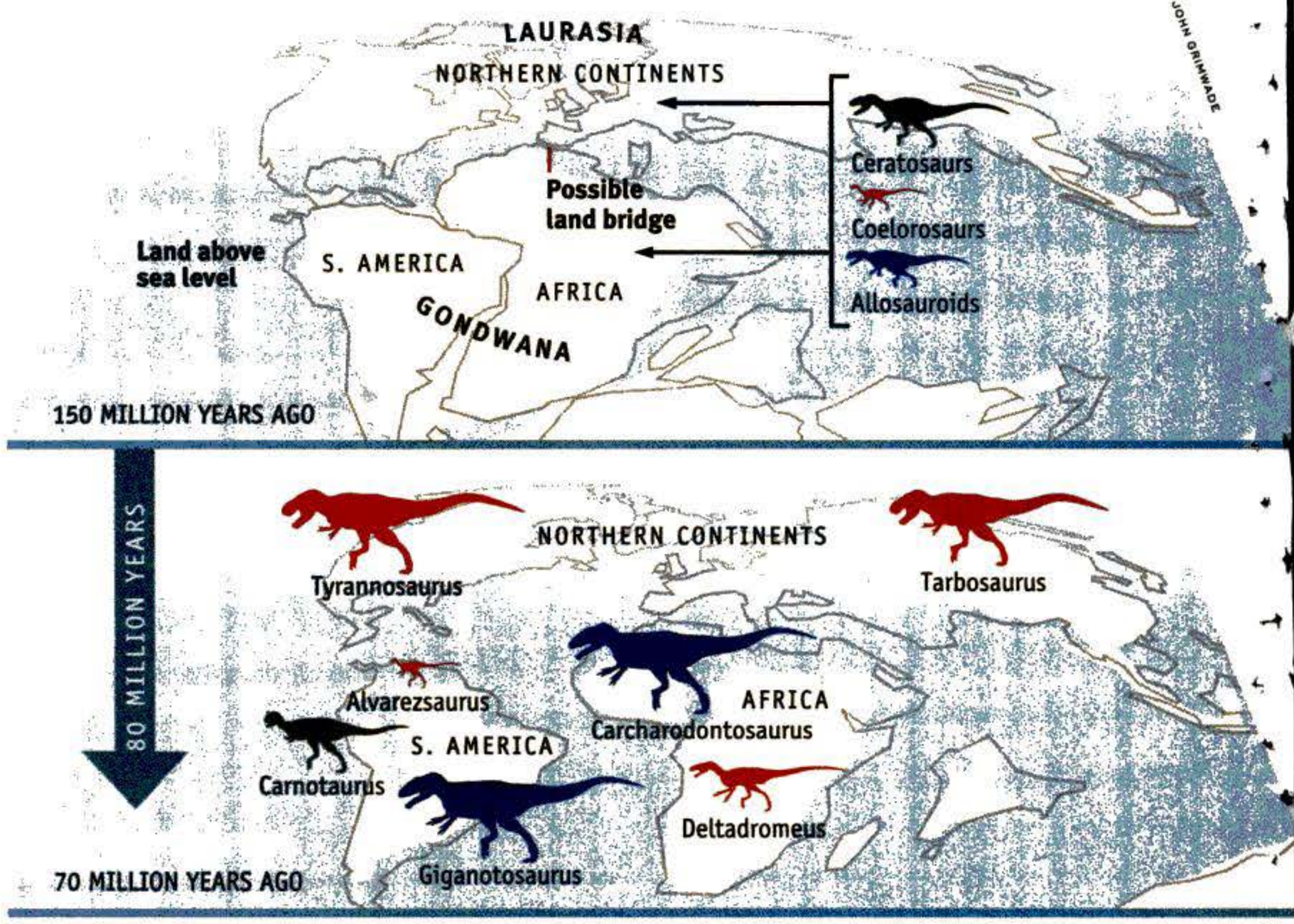


ILLUSTRATION BY AL KAMAJIAN

Dinosaurs on the Move

Simply finding new dinosaurs can be exciting. But to scientists, what's even more intriguing is learning where they fit into the puzzle of evolution—and what they can reveal about how Earth itself has changed over time.



Free Range

After the supercontinent Pangea split, an arc of islands may have enabled dinosaurs to cross for far longer than originally thought. Three main predator lines existed: Ceratosaurs, Allosauroids, and Coelurosaurs.

Big Breakup

Land masses later separated altogether. Ceratosaurs disappeared from North America and Africa but remained in South America. In the north, Coelurosaurs became dominant in *Tyrannosaurus*. In Africa, Allosauroid *Carcharodontosaurus* reigned. A distant survivor of the Coelurosaurs, *Deltadromeus*, also remained in Africa.

dull reddish color of mineralization, it feels cool and smooth, despite having been assembled from many tiny fragments. The edge is serrated, like a bread knife. I run my finger gingerly along the length. "Careful," cautions Dutheil. "It can cut you." Still dangerous after 90 million years.

What next for Sereno? He plans to return to Africa, among other places. It seems that anywhere he goes, he will find something. "I feel that we will," Sereno says definitively—and then laughs at his own boldness. "I think we will because we're smart about where we go, and once we get there, there are a hundred decisions to be made but we have the energy, the wherewithal, to pull it off."

Beyond the logistics, beyond the adventure, looms Sereno's larger goal: "It's a massive detective story," he says. "You've got little pieces, and they're spread around the globe in museums and in specimens people don't even know about, more than 150 million years of dinosaur evolution. You've got to become encyclopedic with your knowledge of these bones, you've got to know them upside down, backward, and you forget and you learn again, and you take copious notes and photographs and follow any interesting lead. There is so much going on in these bones. That's why I became a paleontologist."

He stares past me now, looking back across the evolutionary expanse of time. "The skeleton is like a candelabra of all these bones that are changing," he says. "The limbs are getting shorter, you're losing fingers, you're adding horns, you're stiffening the tail, you're developing wings. It's amazing what has gone on." ◆

Dinosaurs We Never Knew

IN AFRICA, PAUL SERENO'S TEAM FOUND HUNDREDS of craters left by fossil poachers. "Part of the [evolutionary] story is already missing," says Sereno. "There's no way [amateurs] would have collected the specimens we collected. They would have been destroyed." Dinosaur teeth sell for a dollar apiece in African markets, but it doesn't stop there. A smuggled cache of 78 dinosaur eggs worth $10 million was seized in China earlier this year.

While a U.S. Senate bill proposes to protect fossils on public lands, the American Lands Access Association, a lobbying group of commercial and amateur collectors, suggests allowing collectors on public land with a permit, and giving museums first crack at buying anything "significant."—*M.D.*

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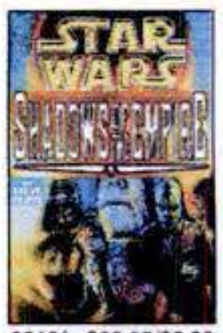
Here's your chance to cut out for exotic new places



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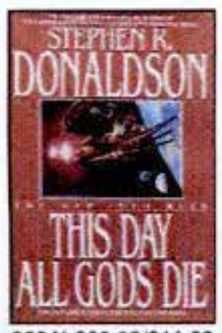

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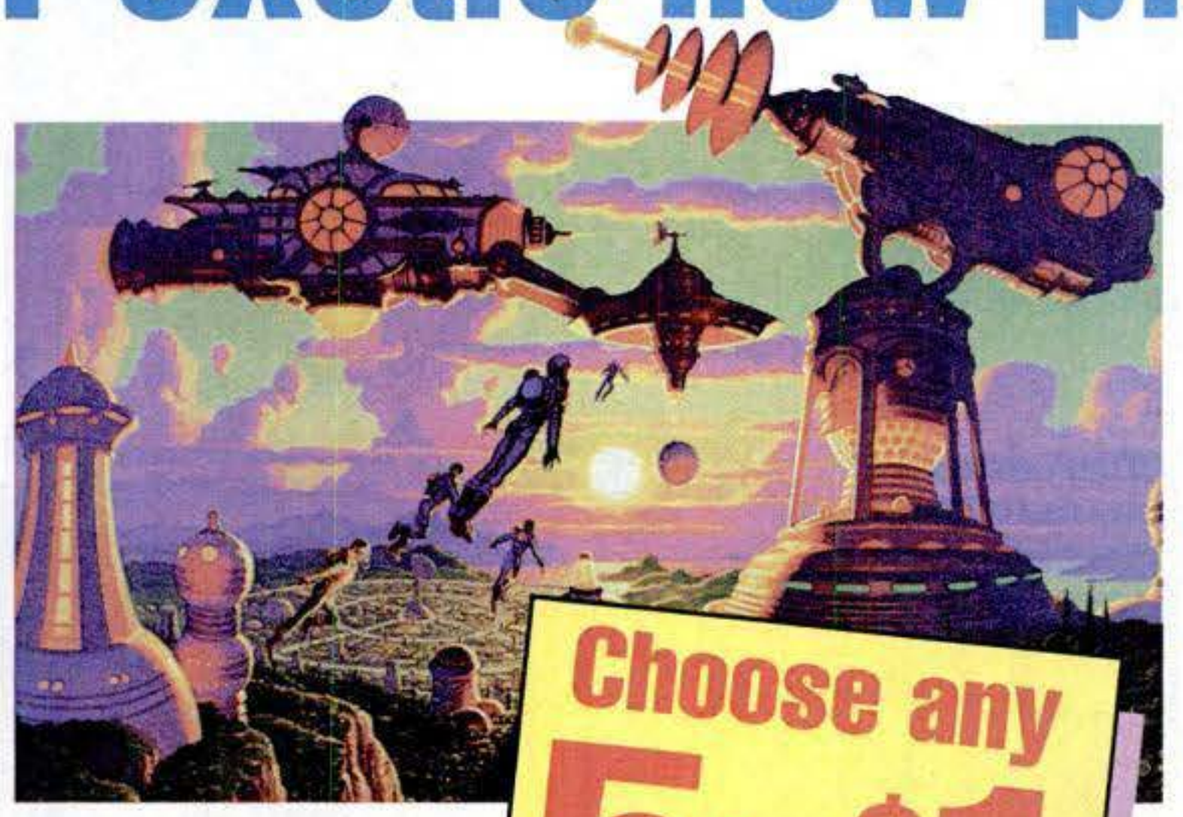

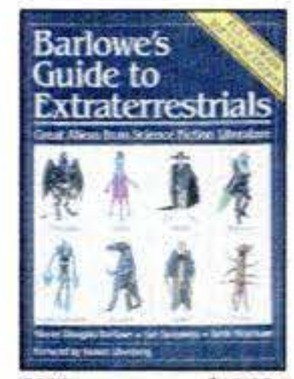

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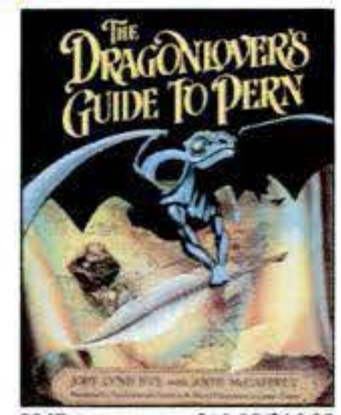

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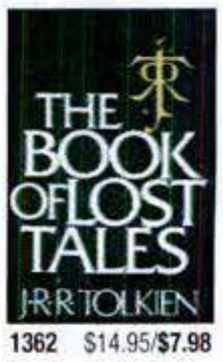

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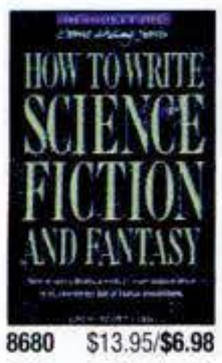

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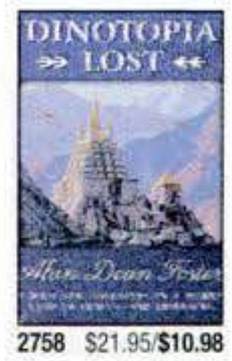

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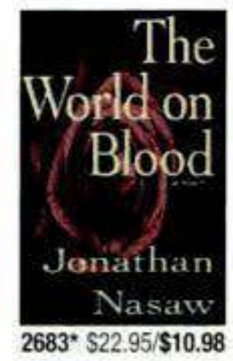

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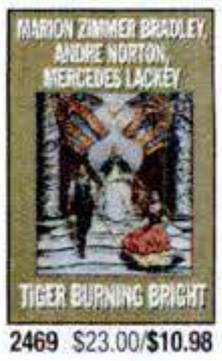

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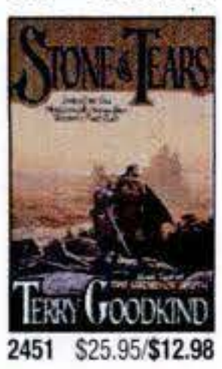

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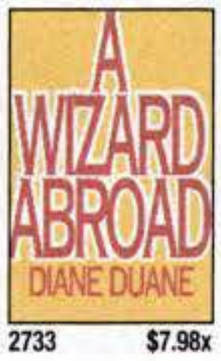

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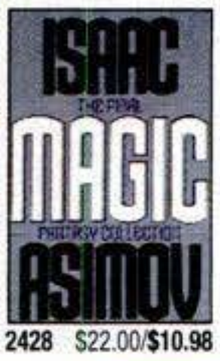

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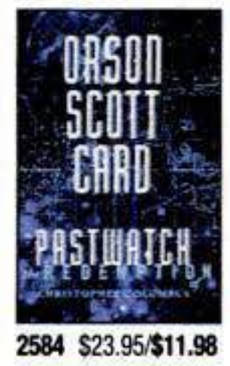

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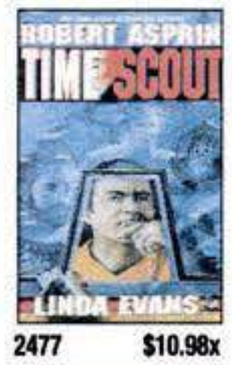

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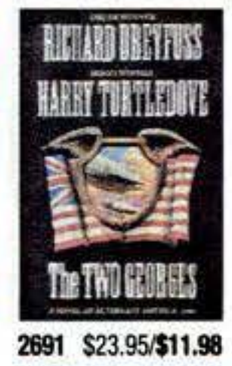

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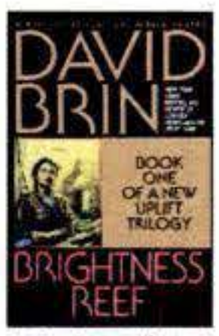

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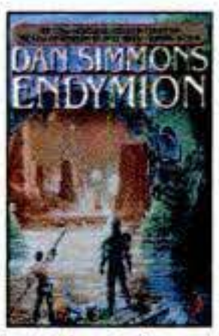

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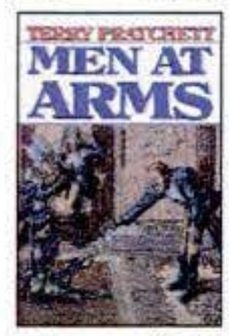

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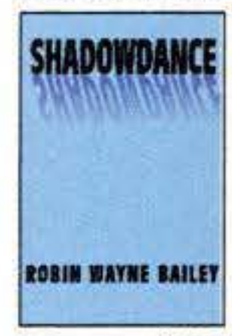

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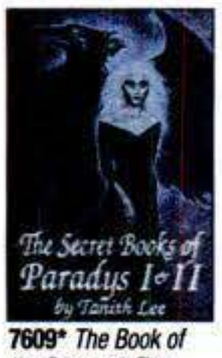

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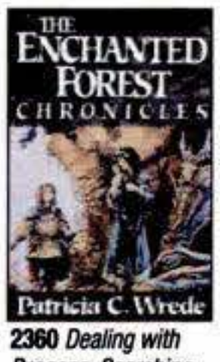

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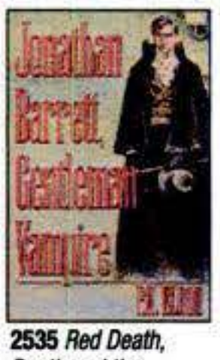

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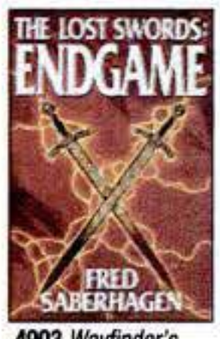

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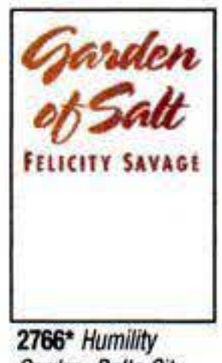

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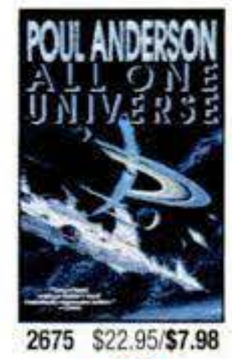

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Pickup Playoff:

REINVENTING THE FULL-SIZE pickup truck is about as difficult as finding an alternative to horse and saddle for exploring the badlands. Ford's saddle horse of choice, the F-150, was last overhauled in 1980. In some respects, this gray mare was in danger of a trek to the glue factory.

The all-new 1997 F-150, however, is chock full of fresh thinking and advanced technology, including a new overhead cam powerplant , suspension, and aerodynamic body.

To help determine how much of this design upheaval represents genuine progress, we used a handy reference gauge: the second-best-selling full-size pickup truck. The Chevy C-1500 selected for comparison-test purposes is nearly identical to Ford's prodigy in equipment and specifications.

By Don Sherman

Ford vs. Chevy

The redesigned champ squares off against its retuned top challenger.

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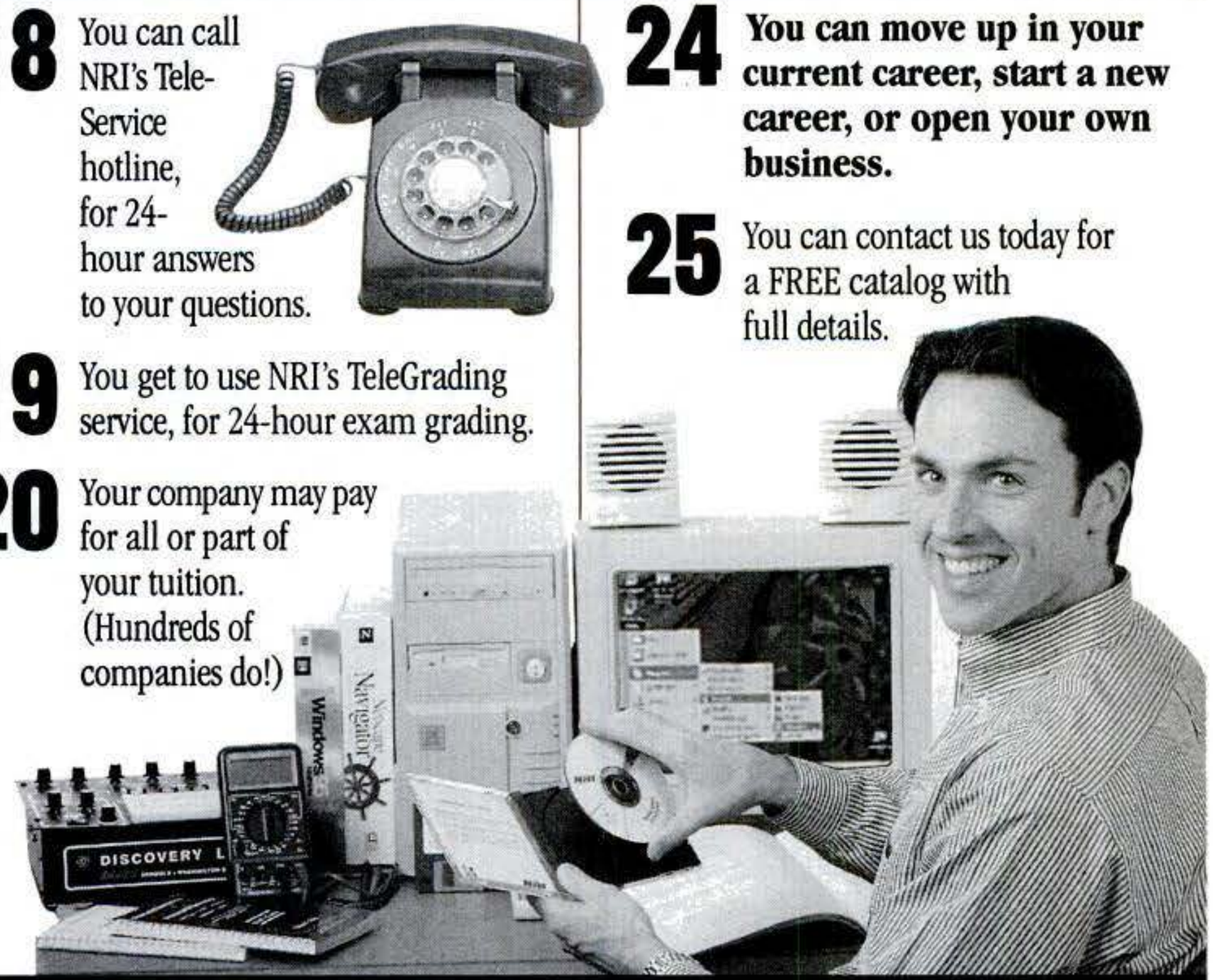

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Though it's currently the oldest full-sized design on the market, the C-1500 does benefit from recent improvements. Last year its interior was refurbished, and there's more horsepower under the hood for 1996 thanks to the addition of port fuel injection to the three available V8 engines.

Compared to the curved and contoured F-series, the C-1500 is as square and upright as a shipping crate. The radical change in exterior appearance helps the F-series blend in with mainstream sedans such as Ford's Contour and Taurus, though contemporary styling was only one of several design goals. Other priorities were increased passenger space, significantly better gas mileage, and a quieter interior. To achieve the first two of these ends, the F-series is substantially larger but also more streamlined than the truck it replaces.

Ford's new styling adds interior room and forward visibility (above). The new third door (left) allows access to the rear seat; two release handles give Ford an advantage.

Since the increase in frontal area is neatly offset by a reduction in drag coefficient (from 0.48 to 0.45), the new truck is no more difficult to propel through the air than the previous model. Other factors, principally a more efficient powertrain design, jump highway fuel economy an impressive three mpg. Addressing the third goal, design changes to reduce wind noise have made the new Ford a significant 2dBA quieter than the Chevy at a steady 60 mph.

In their quest for a larger interior, Ford engineers added two full inches to overall height. That helps headroom, where the F-150 excels, but the rectilinear Chevy holds the upper hand in both leg and shoulder room. The bottom line is that the Chevy is not only slightly more spacious inside, but it's also built lower to the ground for easy entry.

Chevrolet's once-radical aero-look retains its appeal; Chevy says it will continue the design for several years. The new third door, on the passenger side, is unlatched from inside the door jamb, which means opening the forward door first.

The climb up and into the tall F-150 is bound to annoy a few recruits from the car and compact-pickup ranks. One disadvantage with aggressively curved bodywork is that it can limit how wide open a door can swing. This is most evident with the third door, a new feature for both models in this test. Both Chevy and Ford rear-hinged designs swing 90 degrees for handy access to the aft seating and cargo area provided by an extended cab. But because the Ford has more upper curvature—what designers call tumblehome—its rear opening is more restricted than the Chevy's.

Another difference crops up in the front-passenger seat-belt location. Chevy attaches this equipment to the third door so everything swings out of the way. This benefit does not, however, offset the downside, which is that

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the front passenger must unbuckle before the door can be opened. Ford mounts its belt to the roof and floor, a superior arraignment.

Having two third-door release handles gives the Ford another advantage. One is mounted in the jam area, the other on the door's inside surface. The Chevy's only release handle is in the door jam.

The versatility of a third door is only one of the enticements for family-sedan owners to trade in their four-door models for a pickup. Car converts will discover an abundance of cupholders, map pockets, and power plugs to help ease the transition. Both Chevy and Ford pickups also offer CD stereo sound systems comparable in performance to luxury sedan equipment.

Ford has gone the extra mile for side-impact projection by providing not only a horizontal beam in all three doors but also a substantial vertical reinforcement for the rear door. The result? The Ford F-150 already exceeds 1999 Federal side-impact requirements while the Chevy C-1500 doesn't.

Not resting on its laurels, Ford continues to meet rising expectations in occupant safety by being the first full-size pickup to provide dual airbags. Chevrolet will add a second airbag for the right-front passenger as standard equipment in the '97 model year. Acknowledging that young families make up a significant share of the customer base, Ford has also installed a switch that permits disabling of the right-side airbag when rear-facing child-safety seats are in use.

While interior compartments of pickup trucks have undergone rapid and radical change in response to customer demands, the underpinnings of these vehicles have remained relatively stable for decades. The most notable upgrade for the new F-150 is a shift to an unequal-length control-arm front suspension, a design both Chevy and Dodge have used for years. The new fully independent front suspension replaces Ford's twin I-beam design first introduced in 1965. Twin I-beams were in fact an improvement

	1996 Chevrolet C 1500	1997 Ford F-150
ACCELERATION		
0-30 mph (sec.)	3.3	3.3
0-60 mph (sec.)	9.3	9.2
TOP GEAR PASSING		
30-50 mph (sec.)	4.3	4.2
50-70 mph (sec.)	6.0	6.2
HANDLING		
Double-lane change (mph)	51.5	53.1
600-foot slalom (mph)	43.2	44.4
60-0 MPH BRAKING		
Cold (ft.)	162	157
Warm (ft.)	156	152
Hot (ft.)	167	166
INTERIOR NOISE		
Idle (dBA)	45	44
60 mph (dBA)	65	63
0-60 mph (dBA)	73	72
EPA MILEAGE		
City/Highway (mpg)	15/19	16/21
POWERTRAIN		
Engine	5.0L V8	4.6L V8
Valves/cylinder	2	2
Power (hp @ rpm)	220 @ 4,600	210 @ 4,400
Torque (ft-lbs @ rpm)	285 @ 2,800	290 @ 3,250
Transmission	4-speed automatic	4-speed automatic
CHASSIS		
Front suspension	Unequal-length control arms, coil springs	Unequal-length control arms, coil springs
Rear suspension	Rigid axle, semi-elliptic leaf springs	Rigid axle, semi-elliptic leaf springs
Brakes, f/r	Vented discs/drums, power assisted	Vented discs/drums, power assisted
ABS	4-wheel	4-wheel
DIMENSIONS		
Wheelbase (in.)	141.5	138.5
Length (in.)	224.0	224.0
Width (in.)	76.8	78.4
Height (in.)	70.4	72.8
Curb weight (lbs.)	4,640	4,420
Fr./rear distrib. (%)	58/42	58/42
Fr./rear headroom (in.)	39.9/37.5	40.8/37.8
Fr./rear legroom (in.)	41.7/34.8	40.9/32.2
Fr./rear shoulder room (in.)	65.4/67.6	63.8/64.7
Passenger volume (cu. ft.)	113.8	107.3
Gross vehicle weight (lbs.)	6,200	6,000
Trailer tow capacity (lbs.)	7,500	7,000
Fuel tank (gal.)	34	25
SAFETY FEATURES		
Airbags	Driver only	Dual
Side impact protection	No	Yes
Child door locks	Not applicable	Not applicable
PRICES		
Base price	$17,486	$16,500
Price as tested	$23,787	$23,970
Major options	Silverado trim, $3,164; automatic transmission, $970; 5.0-liter V-8 engine, $495; third door, $420; other options, $1,252	XLT package, $3,880; automatic transmission, $971; 4.6-liter V-8 engine, $637; ABS, $500; other options, $1,482

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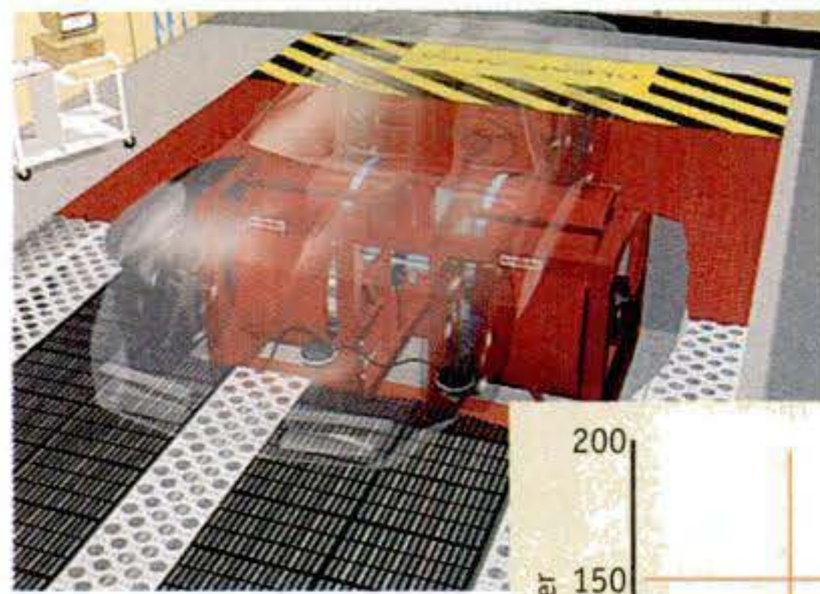
Power at the Wheels: A Chassis Dyno Profiles True Engine Performance

A SWIRL OF controversy follows the F-150's 4.6-liter SOHC Triton engine, the latest variation of Ford's modular V8 introduced in 1991 for the Lincoln Town Car. Why? According to popular belief among truck owners, the smaller overhead-cam engines are great for high-end horsepower but inferior to larger pushrod designs for towing a camping trailer up a mountain grade.

To shed some light on the issue, we supplemented our acceleration test with several chassis-dynamometer test runs at the Lingenfelter Performance Engineering facility in Decatur, Indiana. Previous track tests already had yielded a virtual dead heat. Naturally, the Ford's lighter weight played a pivotal role in these results.

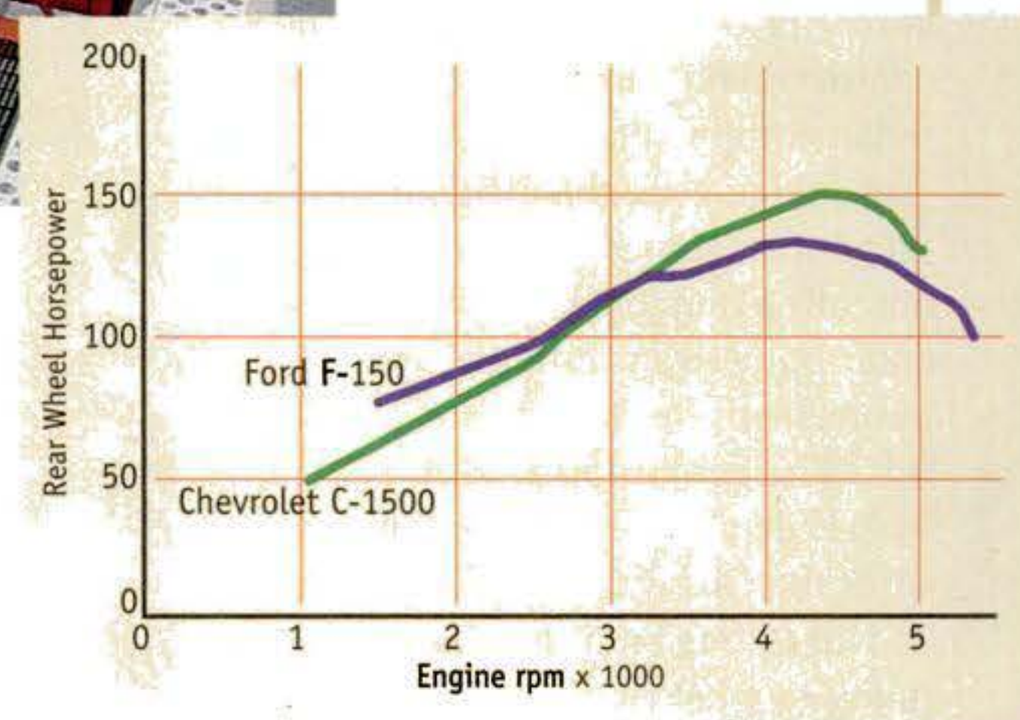
To eliminate that variable ,we turned to a test called the DynoJet chassis dyno. Here, the truck remains static while its drive wheels spin a pair of 48-inch steel drums, allowing the engine to perform independently. Sensors measure drum speed and send that information to a laptop computer for analysis. The torque necessary to accelerate the drum can then be calculated and plotted versus road and engine speeds.

The setup also measures the influence of transmission ratios, final-drive ratio, tire size, and torque-converter characteristics. The dyno clearly shows that the 4.6-liter Ford V8 is more potent below 3,200 rpm, but that Chevy's 5.0-liter engine holds the upper hand above that speed. This is precisely the opposite of what conventional wisdom would have you believe.



The results are not affected by camshaft location. The most significant factor is intake-manifold design. Ford uses long-tuned runners and a two-mode plenum design to maximize output across the full rpm range. Chevrolet uses a simpler, more compact design with short runners and a fixed-volume plenum, a combination that boosts output in the upper registers.

Ford's engine is 2dBA quieter and noticeably smoother during full-throttle acceleration than Chevy's V8, the lineal descendant of the legendary small-block engine introduced in 1955. That workhorse, incidentally, is scheduled for replacement in about two years.—*Don Sherman*



The chassis dyno test defied common wisdom regarding overhead cams: Chevy outperformed the Ford at high rpm.

over solid beam axles because they combined durability with independent wheel movement. Unfortunately, a major secondary problem was associated with this design. Twin I-beams are effectively swing axles that provide an excessive amount of camber change (wheel tilt in the vertical plane) as each tire travels up and down over bumps. The new control-arm design solves that problem and also permits the engine to be mounted much lower in the chassis. Another new F-150 feature is optional four-wheel antilock brakes, a system Chevy made standard in 1995.

The new F-150 feels agile and light on its feet thanks to new suspension tuning, less steering friction, and the fact that it's hauling 220 fewer pounds (empty) than the smaller Chevrolet. (A portion of the weight savings is attributable to a smaller fuel tank. Ford also specified aluminum for the driveshaft, hood, and cylinder heads.)

Our subjective impressions were verified by test-truck measurements: The new Ford beat its seasoned challenger decisively in slalom and double-lane-change tests. The lighter Ford's stopping distances were also a few feet shorter than the Chevy C-1500's.

On the road, we noticed that the Chevrolet demonstrated slight advantages in both directional stability and ride quality. The tall Ford F-150 was more susceptible to side-wind disturbances and more likely to jiggle its occupants over textured pavement. When seating comfort is factored into the equation, however, our preferences swing back toward the new model. The shape of the lower cushion in the Chevy's seat has us squirming in search of better support after only an hour in the saddle.

Nearly 700,000 customers endorsed the previous F-150 pickup truck as a worthwhile purchase last year, but that didn't stop Ford from mustering the courage necessary to reinvent its most successful product. The effort has paid major dividends. The new F-150 is better than its closest competition in practically every category, proving that advanced technology can indeed groom Old Paint for another stint of faithful service. ◆

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IT'S A SMALL WORLD OF science and technology after all. Or so it seems when you're on the Internet, careening electronically from a space shuttle launch in Cape Canaveral, Florida, to a particle physics meeting in Amsterdam. At the same time, the Net continually reminds you that it's a wide, wide world, too, with an astonishingly numerous and diverse array of science interests represented.

Like nearly everything else about the Internet, science and technology on the Net is simultaneously fascinating and frustrating, wonderful and weird, limitless and limited. It's no surprise that sci-tech is virtually everywhere on the Internet. The Net began (and was, until its recent explosion) largely a network of high-tech research centers and government agencies. So the seeds for a science-rooted Internet were planted early. And those seeds have blossomed into an amazing variety of sci-tech sites in cyberspace, especially on the multimedia World Wide Web. The Web now has well over a million sites by most estimates, and perhaps as many as 20 percent of them are science and technology sites.

Use our guide as a road map. It may not take you everywhere, but it'll get you pointed in the right directions.

ILLUSTRATIONS BY PHILIP ANDERSON

Surfing for Science

By Chris O'Malley

The Internet is brimming with science and technology. Here's where to find it.

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ScienceDaily

For the serious science junkie, a daily fix of the latest research news from the labs and tech centers of North America. **http://www.sciencedaily.com/index.htm**

NASA Shuttle Web

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Earthquake Information

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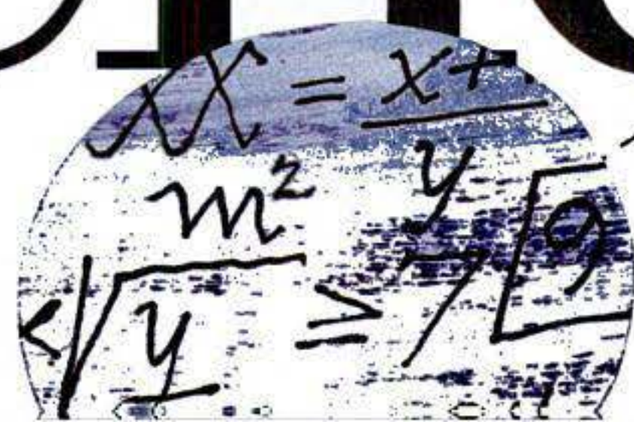

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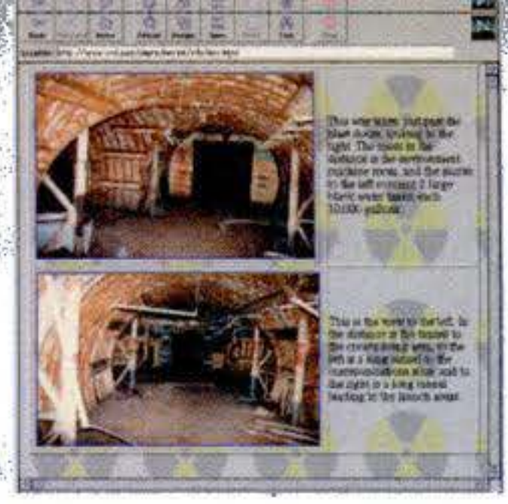

Ocean Planet

Explore the world's oceans without a ship via this Smithsonian exhibit.
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Exploratorium

An eclectic array of exhibits, activities, and news, the online showcase of San Francisco's hands-on Exploratorium is as good a place as any to start a Web museum tour—for kids or adults.
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Visit the Skeletal Remains of a Cold War Weapon

An unauthorized pictorial tour of a decommissioned missile complex. **http://www.xvt.com/users/kevink/silo/silo.html**

Museum Tour Guides

The Computer Museum

Into computers? This is your spot, with a variety of online exhibits, including a 3-D model of the Walk-Through Computer 2000.
http://www.net.org/

Carnegie Science Center

A serious science museum, this online version of the Pittsburgh center can whet your appetite for sci-tech in many ways, from Science in Baseball to Kitchen Theater.
http://www.csc.clpgh.org/

Museums are one of the most interesting categories of science sites on the Web. Some are merely road maps to the museum buildings, but many are engaging, interactive sites that stand on their own.

The Franklin Institute Science Museum

Like old Ben himself, the Philadelphia-based Franklin Institute is into hands-on science, and that's reflected in its online exhibits.
http://sln.fi.edu/

The Nine Planets

A multimedia tour of the solar system and its many moons.
http://seds.lpl.arizona.edu/nineplanets/nineplanets/

Volcano World

How volcanoes work, and what's erupting now.
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http://whyfiles.news.wisc.edu

Learning About Science

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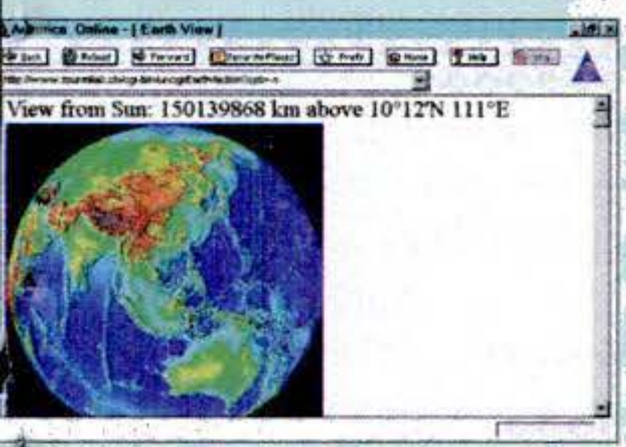
http://www.fourmilab.ch/earthview/vplanet.html



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http://www.webdirectory.com

Web Browsing Made Easy

A VAST BODY OF SCI-TECH information is available on the World Wide Web, and the data is changing by the hour. Which leads to an obvious question: How do you keep up? A new crop of software Web-seekers are providing some answers.

Virtually any Web browser, such as Netscape's Navigator or Microsoft's Internet Explorer, can help you maintain a list of favorite Web sites for easy access. But typically, you're on your own at unearthing new information on these sites, or searching for additional sites on the same or a related topic. But programs with names like NetBuddy, Surfbot, and WebCompass can beef up your browsing capabilities dramatically. Most such programs cost less than $50, and some are free.

Essentially, these Web-masters fall into two categories: monitors and searchers—though there is often some overlap. Monitoring programs such as NetBuddy (Internet Solutions), Smart Bookmarks (First Floor Software), and Surfbot (Surflogic) replace or augment a browser's favorite-site feature by not only keeping a list of Web pages you want quick access to, but also by periodically detecting and alerting you to changes in those pages. You can tell NetBuddy to check certain pages at regular intervals, for example. The program can also show the text of the page with the changes highlighted.

Searching programs are designed to make the process of hunting for Web sites more efficient by letting you do some searches off-line and/or search the Web using several online search engines (such as Lycos, Yahoo, and WebCrawler) at once. Internet Mania (Corel) and CyberSearch (Frontier Technologies) each come on a CD-ROM disc and include a "snapshot" database of the first half-million records in the Lycos Web site database for off-line searching. CyberSearch's database is updated monthly for a $9.95 fee. WebCompass (Quarterdeck) and Web.Max (Berkeley Systems) can leverage a half dozen or more online search engines simultaneously—rather than forcing you to query them separately—and coordinate the results. WebCompass lets you easily construct your own index of Web sites and can automatically generate summaries of the pages it retrieves from the Internet.

Eventually, some of these features will no doubt be incorporated into popular Web-browsing software. But for now, these Web helpers can give your search for sci-tech information a much-needed kick in the cyberpants.—*C.O.*

Science Learning Network

A great site for educators and students alike, its "inquiry resource" projects can help bring science to life, from creating wind-powered machines to dissecting a cow's eye.
http://www.sln.org/

National Geographic Online

Nearly as engaging as its print and TV counterparts. Browse through the Map Machine or take off on an expedition at this visually stunning site. **http://www.nationalgeographic.com**

Invention Dimension

An online clearinghouse for inventors, inventions, and anyone who is intrigued by them. This site is especially useful for K-12 students and their teachers or parents.
http://web.mit.edu/invent/

Whole Frog Project

Want the hands-on dissection experience without, well, the hands-on? You can get it here, thanks to some nifty 3-D imaging and options (like "undissection") you don't get in the lab.
http://george.lbl.gov/ITG.hm.pg.docs/Whole.Frog/Whole.Frog.html

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Hands-On Science Centers Worldwide

A master list of public science museums and science centers worldwide, with a focus on places with interactive exhibits. **http://www.cs.cmu.edu/~mwm/sci.html**

Finding the Best Links

Where do you find all this stuff? You find a good index or link page first, then click your way from one site to another. A site with great links is gold in the Web world.

Point Communications

Point provides noteworthy science sites and critical reviews. **http://www.pointcom.com/categories/science/**

Yahoo - Science

Yahoo is one of the most popular and comprehensive Web indexes, especially for science and technology sites. **http://www.yahoo.com/text/Science/**

Not everything is easily categorized—a lesson that's reinforced with every venture onto the wild and woolly Web.

Science Smorgasbord

Russia on the Net

Russian science and technology centers on the Internet. **http://www.ru/sci/**

Human Genome Project

Check in on an ambitious 15-year effort to find all of the genes in the human body and to detail their biochemical makeup. **http://www.ornl.gov/TechResources/Human_Genome/home.html**

Area 51 Research Center

The infamous Groom Lake military base north of Las Vegas is a mecca for military technology buffs and UFO watchers alike. **http://www.ufomind.com**

Science Site Road Map

Courtesy of the Society for Amateur Scientists. **http://www.cfn.cs.dal.ca/Science/SAS/sas-sub1.html**

High-Technology Gateway

More than 3,000 hotlinks to high-tech companies, groups, publications. **http://www.prtm.com**

Astronomy and Space on the Internet

Perhaps the most extensive Web list of celestial points of interest. **http://fly.hiwaay.net/~cwbol/astro.html**

Intelligent Agents: Still Dumb After All These Years

THE NOTION OF PERSONAL computers as secretaries or butlers is nearly as old as the PC itself. But with the explosion of online services and information in the nineties, the idea began to take on a new sense of urgency—and a new name: "intelligent agents." Several companies, notably AT&T and General Magic, began proudly promoting the agent concept as the key to their online plans.

Several years later, intelligent agents are as scarce in cyberspace as unscrupulous agents are plentiful in Hollywood. While certain Web-browsing aides such as Surfbot and WebCompass [see "Web Browsing Made Easy"] use the term "agent" to describe their searching and updating features, true intelligent agents have largely yet to materialize. That's primarily because their mission is so ambitious. By most definitions, intelligent agents are sophisticated software programs that go online to secure products, services, or information for you, and—this is the hard part—change their tactics or goals based on what they encounter in their online quest.

The Web's growing info-glut is fueling a great deal of research about intelligent agents, and even a few attempts at creating relatively simple working agents. An innovative Web site called Firefly (*http://www.ffly.com/*) created by Agents Inc., a startup company spun off from MIT's Media Lab, prompts you for biographical information and musical preferences, then recommends CDs based on your responses, for example. More of the same is on the way, as are more complex agents. The next generation of search engines like Yahoo and Lycos are expected to have agents or agentlike options. And many Internet developers are using the Java programming language to create "applets," or small programs transmitted or accessed over the Web, as a way of spreading agent technology.

Online agents may never be as clever as a skilled human researcher, or as accommodating as a real-life butler. But they can help you get a handle on the Web, and that may be worth putting up with the hype surrounding them — *C.O.*

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Science/ Mathematics/ Technology Experts

Need to find an expert in a sci-tech field? Start here. **http://njnie.dl.stevens-tech.edu/curriculum/science.html**

Ask-a-Geologist

Get the dirt from our scientists at the United States Geological Survey. **http://walrus.wr.usgs.gov/docs/ask-a-ge.html**

The Astronomy Cafe

Includes Dr. Odenwald's Ask the Astronomer. **http://www2.ari.net/home/odenwald/cafe.html**

Why do some stars shine brighter than others? Why do things in motion tend to stay in motion? The Web knows the answers—or at least some of its leading lights do.

Answers to Questions

Balfer Free Computer Help Page

Yes, these "internauts" are volunteering to help solve your Windows or Macintosh woes free of charge. Just send an e-mail and they'll get back to you within 24 hours. **http://users.aol.com/balfer/help.htm**

Ask Dr. Neutrino a Physics Question

Here, you can not only ask any physics question you can think of, on subjects from lacrosse to lasers, you can also answer a question if you're so inclined. **http://nike.phy.bris.ac.uk/dr/ask.html**

Participating in Science

Tired of sitting on the online sidelines? A growing number of science sites let you get directly involved in science and technology, either on the Web or off.

The Globe Project

Want to be part of an international science project? Students, teachers, and schools are working with professional scientists to compile environmental measurements and other observations. **http://www.globe.gov/**

Science Hobbyist

Cool science, amateur science, weird science, inventions, experiments, demos, exhibits—this site has a little of everything for the science buff or the casual visitor. **http://www.eskimo.com/~billb/amasci.html**

Building a Solar House

Maine homeowner William Lord shows you how. He should know: He's got a roof that's actually made out of photovoltaic panels instead of shingles. **http://solstice.crest.org/renewables/wlord/solarhouse.html**

Bradford Robotic Telescope

A 46cm telescope situated high on the moors in West Yorkshire, England is pointed at the northern night sky, and you can control it via the Web. Well, you can put in your request for an observation, anyway. **http://www.telescope.org/rti/**

The Robotics Institute

You control Xavier, the robot, remotely. **http://www.ri.cmu.edu/ri-home/robots.html**

TechnoSphere

Create a digital creature and see it venture into a wild, three-dimensional world. **http://194.80.30.14/TechnoSphere/**

U.S. Patent and Trademark Office

Got an idea? Think it's original? The USPTO page lets you search its patent bibliographic database and order copies of patents and trademarks, among other services.
http://www.uspto.gov/

Lawrence Livermore National Laboratory

Explore energy-related programs, publications, and research.
http://www.llnl.gov/

NASA Homepage

There are few sites on the Web with more data than this one. Get the latest NASA news, hotlink to its major centers, peruse its picture and movie gallery, check out shuttle schedules, and explore its educational exhibits. **http://www.nasa.gov/index.html**

Science and technology, like every field, has its associations, governing bodies, clubs, and weighty groups. Most of these have outposts on the Web, where you can get tons of free information.

National Institute of Standards and Technology

Not light reading, but lots of info on NIST labs and grants. Serious stuff. **http://www.nist.gov/**

Are Scientists Leaving the Net?

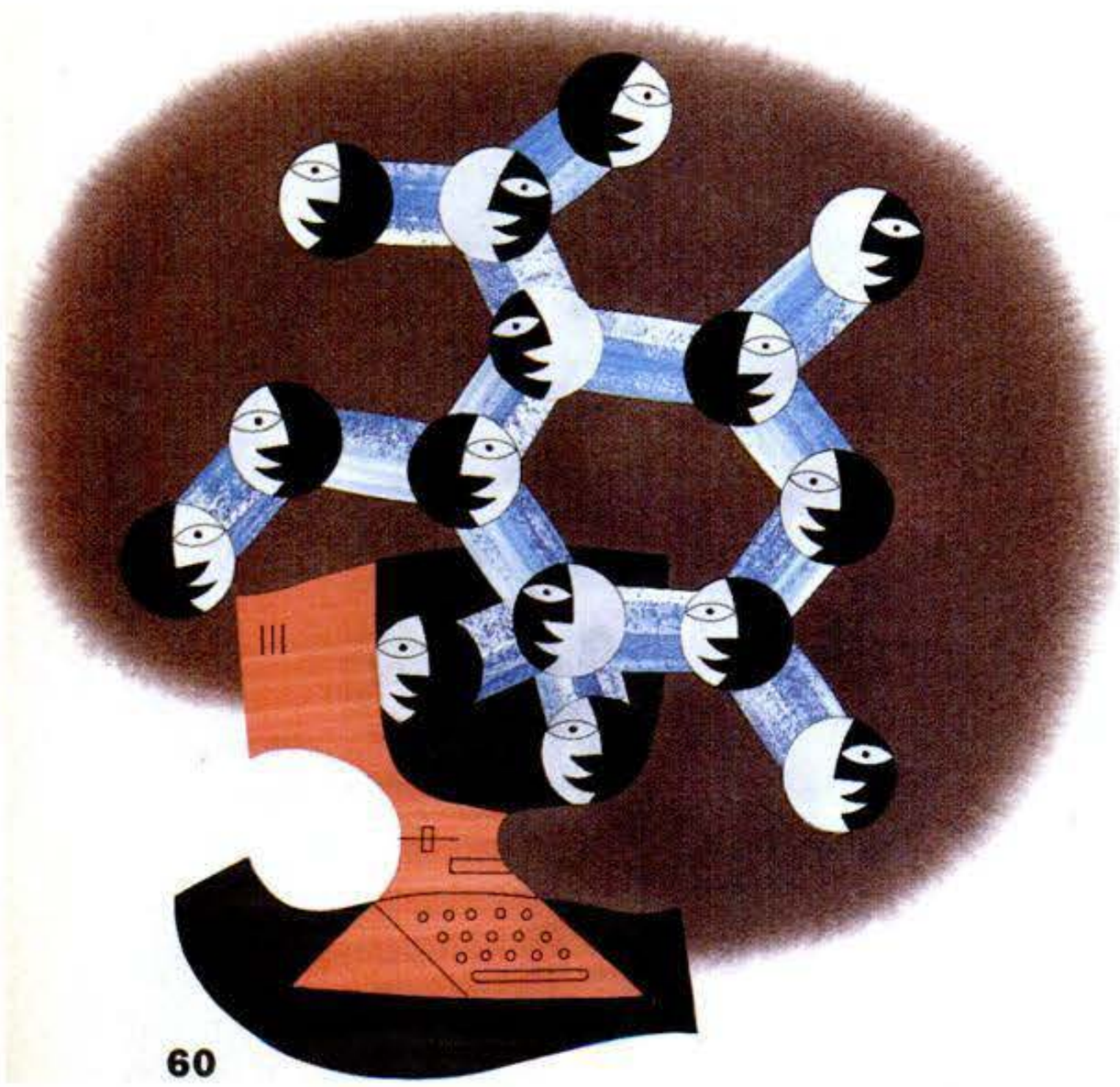
THE SCIENTISTS who helped create the Internet may be leaving it for less crowded cyberspaces. Having been on the Internet longer than the rest of us, scientists use it differently. Premier researchers use the Net to test projects like real-time, 3-D models of colliding galaxies or rampaging tornadoes. For tasks like that, the Internet is no longer fast enough or reliable enough. And some scientists are frustrated. For them, the information superhighway is full of bumper-to-bumper traffic.

Visionary engineers at the National Science Foundation, fortunately, have long foreseen such congestion. As an alternative, they created the very high-speed Backbone Network Service (VBNS). It links a handful of government and university labs at speeds of 155,000,000 bits per second, or 10,000 times faster than a standard modem. By the year 2000, a new generation of equipment and another round of research could give scientists data pipes 12 times faster than that. Among other tricks, these new high-bandwidth networks will allow scientists to manipulate huge computer files so unwieldy they are now shipped by four-wheeled means. "Never underestimate the bandwidth of a pickup truck full of data," jokes Daniel Sandin of the University of Illinois.

Sandin and his team in Chicago will use the VBNS to immerse goggled humans at different locations into the same type of jaw-dropping virtual reality simulation generated by a supercomputer. "You could not do that on the Internet," says Thomas DeFanti, Sandin's colleague. "The Internet is so congested that for any kind of high-bandwidth use, it is essentially rendered useless."

"Simply adding lanes is not going to work," adds Beth Gaston of the National Science Foundation. "Our role is to spur the technology forward."—*Mark Uehling*

Where the Crowds Are



European Science Foundation

A Eurocentric look at advances in science.
http://www.esf.org/

National Academy of Sciences

The projects and activities of the NAS and National Research Council.
http://www.nas.edu/

Woods Hole Oceanographic Institution

This is a fittingly diverse site for the largest independent marine science research facility in the United States—and a holy place to ocean lovers worldwide. Lots of links to other ocean-related pages are here, too.
http://www.whoi.edu/index.html

National Science Foundation

In many ways, this is home base for scientists, science lovers, and proponents of electronically shared science. (The NSF runs the Internet after all, as much as anyone does.) Check out what's happening, what's being funded, and what's being published. **http://www.nsf.gov/**

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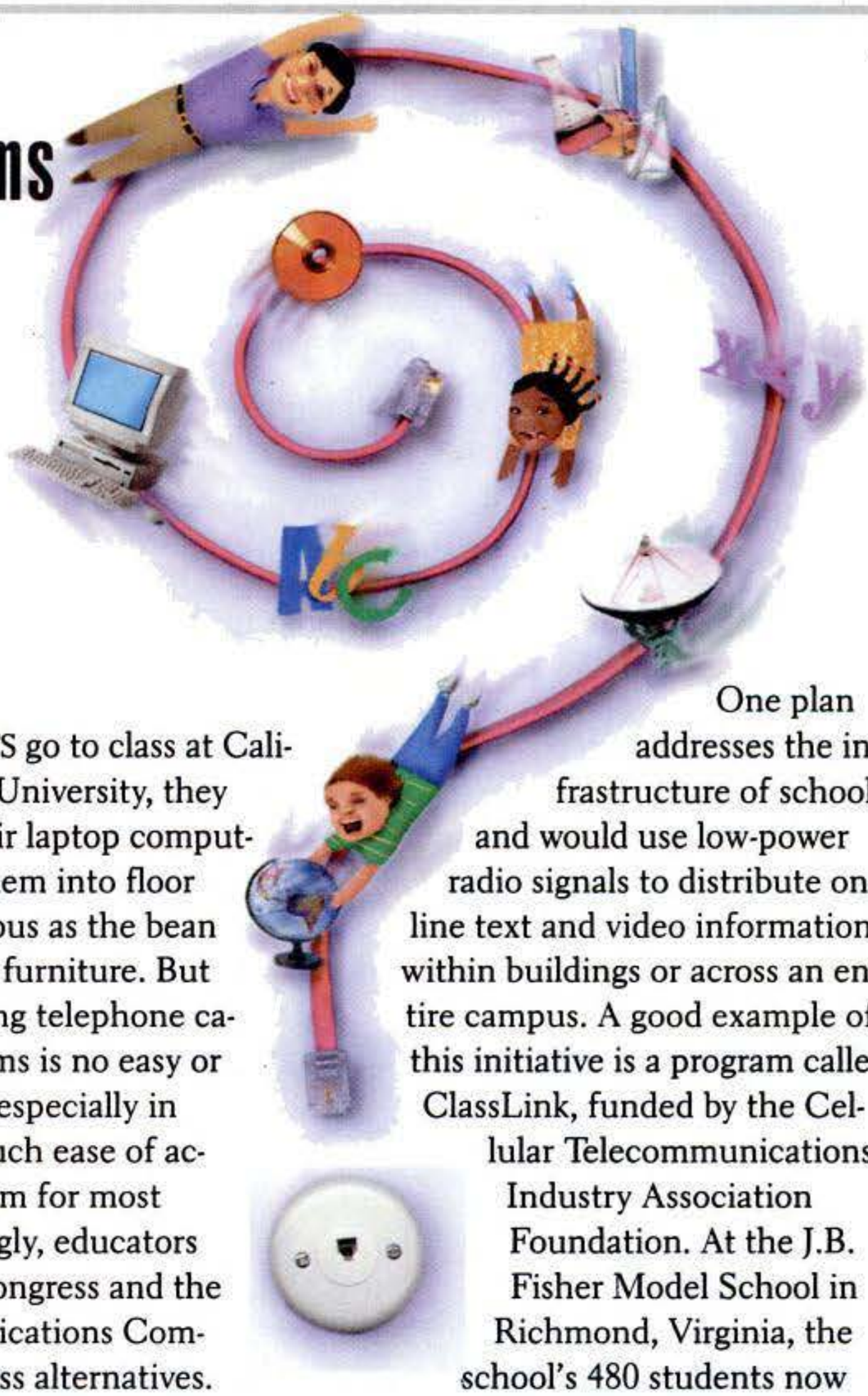
ESSENTIAL TECHNOLOGY GUIDE

EDUCATION

Computers and the Internet are giving rise to virtual universities, and the effects of technology are being felt even in grade schools. Teachers now have to re-think their approach to the subject and may need retraining themselves. Here's how computer science is changing the way you and your children learn. BY STEPHEN A. BOOTH

Classrooms of the Future: Internet Without Wires



ELIZABETH BRANDT

WHEN STUDENTS go to class at California's Stanford University, they can power up their laptop computers by plugging them into floor sockets as numerous as the bean bags that pass for furniture. But because retrofitting telephone cables into classrooms is no easy or inexpensive feat, especially in older buildings, such ease of access is only a dream for most schools. Accordingly, educators are petitioning Congress and the Federal Communications Commission for wireless alternatives.

One plan addresses the infrastructure of schools and would use low-power radio signals to distribute online text and video information within buildings or across an entire campus. A good example of this initiative is a program called ClassLink, funded by the Cellular Telecommunications Industry Association Foundation. At the J.B. Fisher Model School in Richmond, Virginia, the school's 480 students now have Internet access via 15 wireless Ethernet bridges donated by Wi-LAN of Calgary, Alberta. These wireless links provide the students with Internet access at speeds of up to 1.5 million bits per second, roughly equivalent to expensive fiber-optic lines but without the high cost.

Schools In Decay

ACCORDING TO A survey of 7,478 schools by the U.S. General Accounting Office:

- 34% have at least one building in need of repair.
- 57% need major repair work for plumbing, roofing, or other essential areas.
- In schools where the minority population is less than 5.5 percent, 28.7% have at least one building deemed inadequate.
- In schools where the minority population is more than 50.5%, 42% have a building deemed inadequate.

By the Numbers: Who's Online

There are 110,000 elementary and high schools in the United States. According to the U.S. Department of Education, 50 percent of the nation's K-12 schools now connect to the Internet—up from 35 percent in 1994. For high schools alone, the figure is 65 percent. These hookup rates compare to 6 percent among general computer users. Of some 2.5 million classrooms, 9 percent are directly wired. According to Web 66, an online registry, 1,300 schools in the United States have their own Web pages, as part of a total of 2,000 worldwide.

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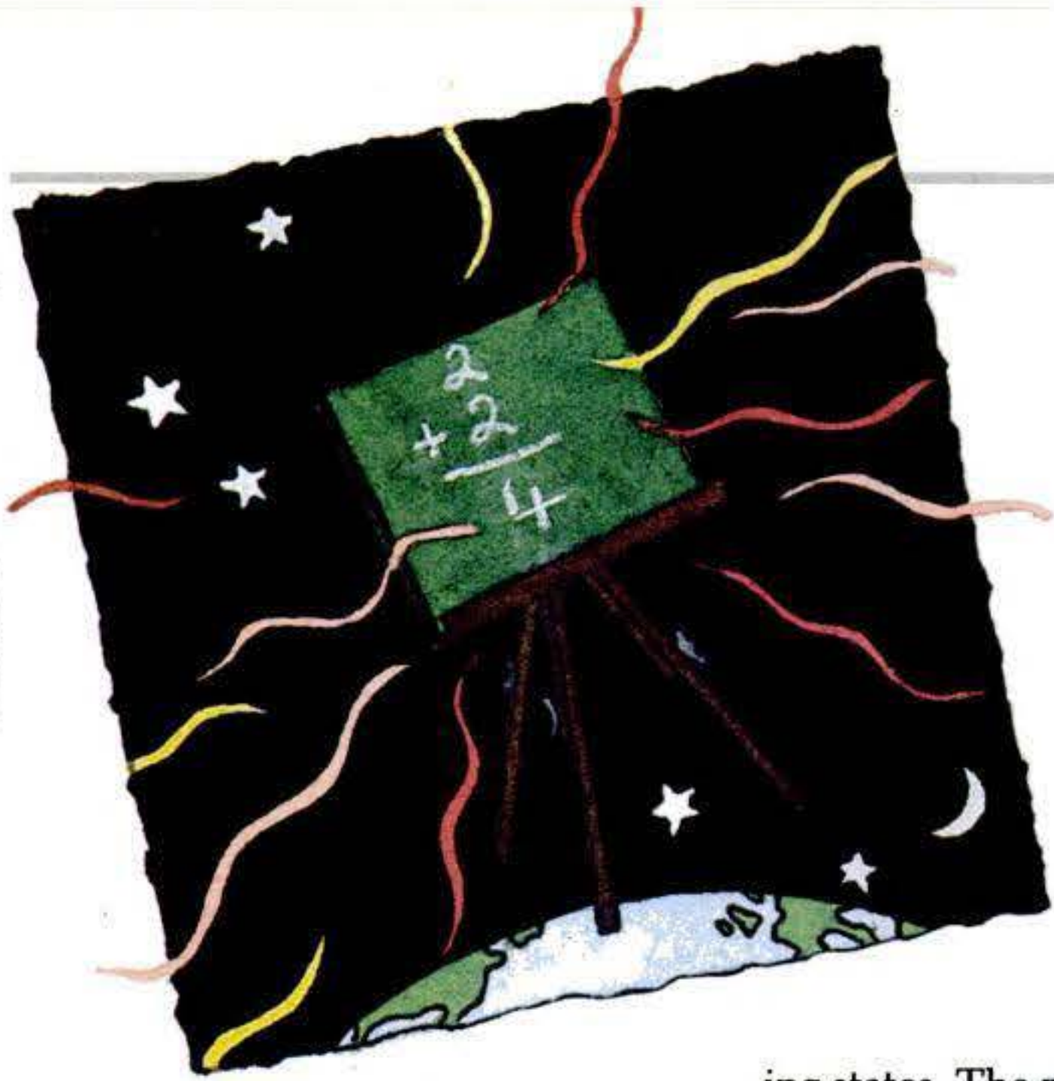

YAN NASCIMBENE

Get a Degree from Internet U.

THE CONCEPT OF a virtual university will take root next year with the opening of the Western Governors University on the Internet. Announced last spring by the governors of 10 western states (not including California), the school will be an accredited regional institution that will exist solely in cyberspace. Students will get learning materials from electronic databases, file term papers via e-mail, and meet in online sessions that use video and voice links. The entire project may have a price tag as high as $10 million, which would be divided among the 10 participating states. The move is in response to the rising costs of educating college students on-site.

Learning from a distance is already available on the Internet in a variety of forms, but not on so grand a scale as in the Western Governors University project. Studies indicate that among adults, distance-learning is as effective as traditional classroom instruction. The jury's still out on the kindergarten through high-school set, however.

Wired for Learning

- **The Family Education Network,** accessible through the Yahoo searcher on the Net, offers links to some 60 institutions with distance-learning programs. (*http://www.yahoo.com/Education/Alternative/Distance_Learning*)
- **The Distance Learning Resource Network** provides information on the subject for educators, policy makers, and parents. It also distributes videos to show schools how to implement distance-learning programs (800-662-4160 or *http://www.fwl.org/edtech/dlrn.html*).
- **The U.S. Distance Learning Association** provides research, statistics, and other services on the subject. Individual memberships cost $100; for organizations, $500-$900 (*http://www.usdla.org*).
- **EduPort** is an ongoing pilot project of IBM and the University of Nebraska that uses Lincoln High School in the city of that name as a test bed. (*http://www.research.ibm.com/xw-eduport* or *http://ianrww.unl.edu/eduport/eduport.htm*).
- Though **International University College** is based in Englewood, Colorado, its B.A. and M.A. candidates in Business Communications earn their credits entirely via the Internet. Their professors might be located physically at teaching institutions anywhere in the United States, but interactive advisers are just a phone call or e-mail away.

VR in the Classroom

IN CASPER, Wyoming, students have an edge. Their school system is one of the first in the world to offer classes in virtual reality. Using VR technology, these students experience the subjects they study. "With virtual reality they can fly around the solar system, enter a human cell, explore the inside of a computer, float down the Nile, or recreate an early American fort," says teacher Marjorie Bisiar, who spearheads the project.

It all started in 1993 with one VR class at Kelly Walsh High School. Today 90 teenagers take the classes at two local high schools, and many more are on the waiting list. Each student works at an IBM-compatible personal computer interfaced with Sega VR glasses, a Mattel PowerGlove, and a Gravis joystick.—*Laura J. Rongé*

LAURA J. RONGÉ

Students in Wyoming create their own VR worlds

RAs with Byte

LATELY, GAINFUL employment can be had by any student willing to carry a beeper and—No, it's not what you think. Any college student with a penchant for PCs and broken sleep might land a paid gig—plus gratis room and board—as the cyber-age equivalent of yesteryear's resident assistant (RA). Their official title is resident consultant, or res-con, and their job is to help undergrads learn the ropes with computers and online campus networks. Though most kids come to school these days with a PC in tow, they often need a computer mentor as much as teachers do. Especially when a term paper evaporates into virtual limbo....

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Web Sites for Teachers

HERE ARE SOME online databases that even Miss Crabtree would love:

- **Quest Project** (*http://naic.nasa.gov/naic/guide/templates/quest.html*) This is NASA speaking to K-12 teachers: an omnibus site for grant info, teaching with the Net, and other teaching resources.

- **AIMS** (*http://204.161.33.100/*) The acronym stands for Activities Integrating Math and Science—a font of learning-by-doing ideas.

How to Get Your School High-tech

IT'S THE SAME story almost everywhere: School districts face reductions in state financial aid, and local taxes can't bridge the gap because property owners are already stretched.

Increasingly, enterprising parents and teachers are working outside the system to get supplemental funding for upgrade projects. Usually this means tapping the private sector—businesses big and small, neighborhood and national—for aid.

More often than not, well-meaning donors discover that schoolboard rules and red-tape make such direct-assistance difficult. Consequently, concerned individuals are establishing not-for-profit education foundations at the community level.

Help for Self-Help:

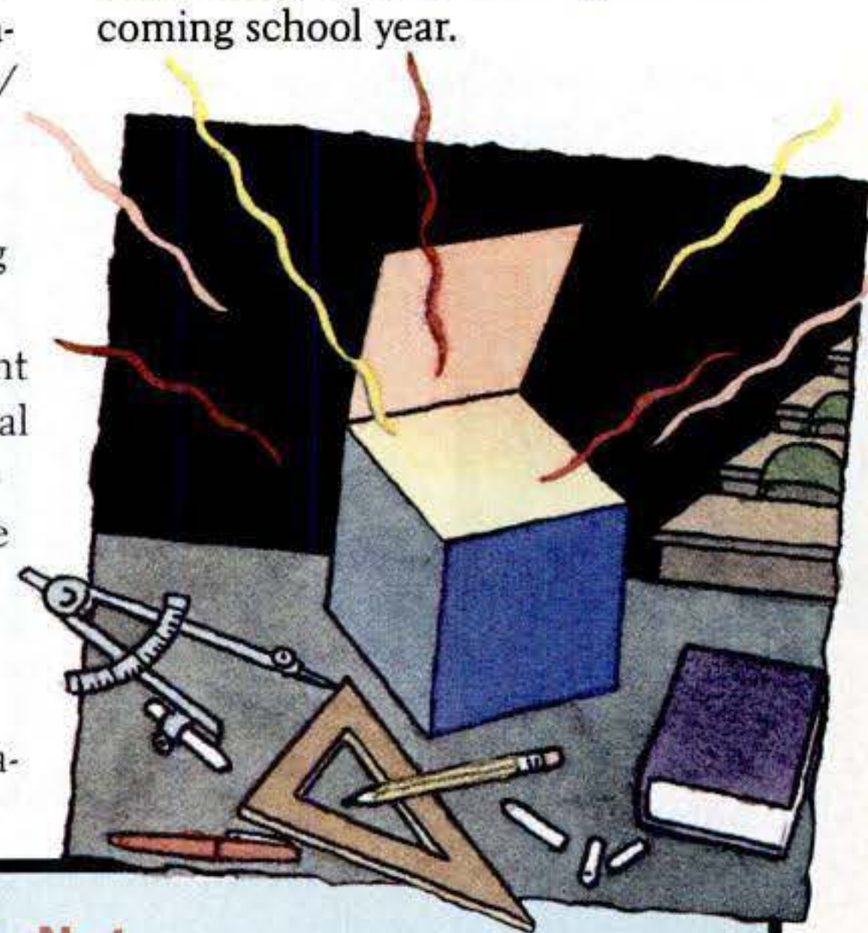
- The U.S. Department of Education offers a free guide "An Invitation to Your Community: Building Community Partnerships for Learning" (800-872-5327 or *http://www.ed.gov*).

Teacher's Helpers

HOW DO EDUCATORS create a curriculum that exploits the potential of multimedia communications? And how do the **school teachers acquire the skills to use equipment** that often is less intimidating and more familiar to the students?

There's work in progress on both issues. For example, the Milken Family Foundation (310-998-2800; *http://www.mff.org*) sponsors a variety of programs to foster technology in teaching applications. Also focusing on teachers is the Science Learning Network (*http://www.sln. org*), a joint project of Unisys Corp., the National Science Foundation, and several science museums. SLN and its Web site provides training and resources to K-through-8 science, mathematics, and technology teachers.

Yet another effort to make educators PC-savvy is 21st Century Teachers (*http://www.educ.org/21stcentury*), created by a consortium of education groups. In bureaucrat-speak, it's a seed program. This summer, the organization sought to enlist 100,000 computer-literate teachers to each act as cyber-tutors for as many as five of their colleagues locally. The hope is to bring 20 percent of the nation's teachers up to speed during the forthcoming school year.



YAN NASCIMBENE

Who's Wired And Who's Not

YOU THINK THE NATION'S HIGHWAYS are in rough shape? A recent study by *USA Today* reports that only a fraction of the PCs found in school classrooms are capable of multimedia performance (that is, they have CD-ROM capability) and are connected to the Internet. Following is a ranking of the 10 best and worst states, according to the ratio of students per multimedia PC.

BEST		WORST	
North Dakota	15.1	Louisiana	88.8
South Dakota	15.4	West Virginia	81.6
Georgia	16.0	Hawaii	74.4
Colorado	16.3	Missisippi	62.7
Wyoming	16.5	Ohio	61.8
Kansas	16.6	Delaware	53.9
Alaska	16.9	Massachusetts	52.7
Nebraska	18.6	California	52.0
Washington DC	19.1	Rhode Island	49.2
Washington	19.2	Arkansas	46.9

Wanted: Big Bird

SATELLITE transmission is yet another route for the education info-highway. Congress is considering a bill (S-1278) to fund the construction and launch of a communications satellite dedicated to disseminating educational programming to schools. According to the National Education Telecommunications Organization, the cost and difficulty of obtaining transponder time on existing commercial satellites now jeopardizes distance-learning programs, especially among rural schools. Launching its own "bird" into orbit should help alleviate the problem, they believe.

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Exploring Loess Hills—Remotely

LOESS HILLS are mounds of silt that have accumulated over hundreds of years in western Iowa. A similar site exists in China, but otherwise the Loess Hills are unique. Students in Johnston, Mt. Ayer, Corydon, and Forest City, Iowa, can explore this special environment by accessing 3.5 hours of multimedia material housed on a video server maintained by the state-owned Iowa Communications Network. The network, which uses fiber-optic cable, is delivered to the schools via a two-way set-top box. Students navigate through the material as they wish, using a remote control. The software, developed by Interactive Resources of Des Moines, Iowa, lets students resume where they left off and keeps track of individual test scores.—*Frank Vizard*

Learning at Home

SHRINKING SCHOOL budgets are putting an added burden on parents to supplement classroom learning at home. Others are educating children on their own.

The Bring Learning Home Alliance offers advice and services. The Alliance's primary outreach vehicle is the Family Computer Workshop, a hands-on session to show parents and kids the potential of a PC at home. For more information, call 800-365-7080, ext. 200. Also try:

- **Family Planet** (*http://family.starwave.com*): Web site with parental advice for children's needs.
- **Computer Learning Foundation** (415-327-3347). Software guides.

Essential Gear for the Classroom

NOT EVERY CLASS will be blessed with banks of Apple Macintosh LC's or IBM EduQuest computers. Today's version of the oldtime one-room schoolhouse is the one-PC schoolroom (sometimes a teacher's personal machine!). Sure, the kids could huddle around a 12-inch monitor, but displaying the lesson on a bigger TV (possibly from the school's audio/video center) would be more comfortable.

Converting PC visuals to a conventional TV screen requires a VGA-to-NTSC converter. These cost about $200 and are available from such companies as Advanced Digital Systems (310-926-1928), Digital Vision (617-329-5400), and Umax (800-286-6186), among others.

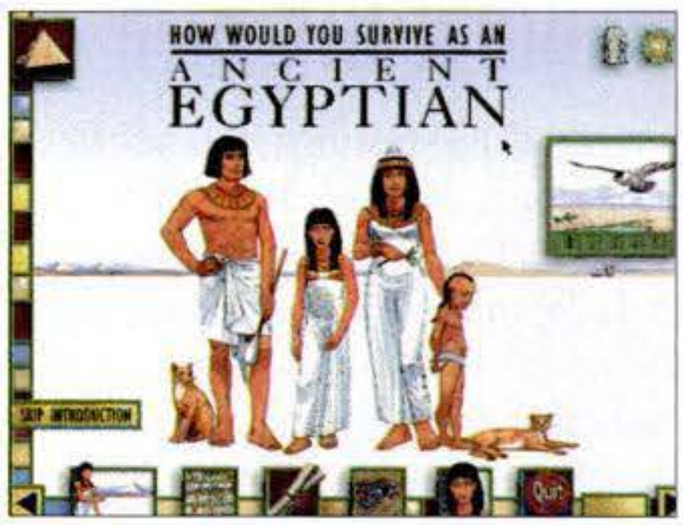
Another option would be to buy a Gateway 2000 Destination. The Pentium-based PC includes an A/V system and a 31-inch monitor (800-846-2000 or *http://www.gw2k.com/destination*). But the $3,500 to $4,700 cost might shock some schoolboards.

Many popular software programs come in school editions with teachers' guides. Sometimes the content on the CD is different than the over-the-counter version (instructors can control difficulty levels, for example), and they're almost always more costly because of the supplementary materials. These often can be ordered separately if the teacher already has a consumer version. A good source for educational software is Learning Services (800-877-9378).

Top-10 CD-ROMs

WHY SHOULD KIDS have all the fun? Parents and grandparents can enjoy these educational CD-ROMs too. Here's our picks.

- **How Would You Survive?** (Grolier; 800-285-4534)
- **Eyewitness Encyclopedia of Science 2.0** (DK Multimedia; 800-DKMM-575; *http://www.dk.com*)
- **A.D.A.M.—The Inside Story** (Animated Dissection of Anatomy for Medicine; 800-408-ADAM)
- **The Oregon Trail II** (MECC; 800-685-6322; *http://www.mecc.com*)



- **Teach Your Kids World History** (Bureau of Electronic Publishing; 201-239-1180)
- **The Way Things Work (With Internet Connection)** (DK Multimedia; 800-DKMM-575; *http://www.dk.com*)
- **A History of Medicine** (FlagTower; 800-608-FLAG)
- **Seasons** (Nat'l Geographic Society; 800-368-2728; *http://www.nationalgeographic.com*)
- **Eyewitness Encyclopedia of Space and the Universe** DK Multimedia; 800-DKMM-575; *http://www.dk.com*)
- **Scholastic's The Magic School Bus Explores the Human Body** (Microsoft; 800-426-9400)

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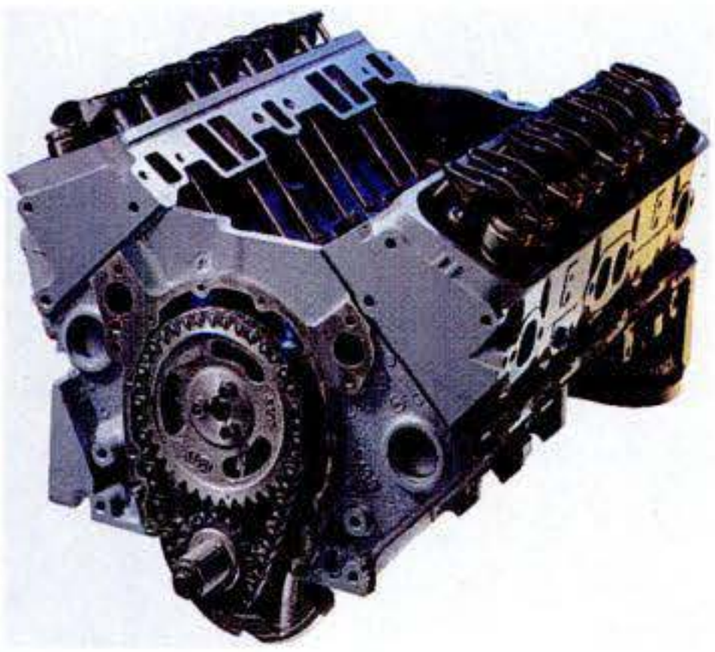
If you're settling for a no-name engine, be sure you buy name-brand shoes.



ACDelco Engine

There are brand names you know and trust for just about all of life's necessities. But until now, no nationally known brand name for remanufactured engines.

But now, ACDelco has put its brand on reman. You get a known and trusted name. A full line covering most makes and models. And a limited 24-month, 24,000-mile full parts and labor warranty, honored nationwide.

Now when you get back on the road with a reman engine, you can have confidence you'll be driving all the way. For more info, contact http://www.acdelco.com or 1-800-ACDelco.

ACDelco

It's like buying time.

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The bleak era of PCs in rectangular boxes may finally be over.

By Chris O'Malley

Radical Chic

Movable Feast

The tilting TFT (thin film transistor) screen folds flat when you want to move the computer, and there's space above the mouse holder where you can stow the keyboard.

FINALLY, A HOME COMPUTER you won't want to hide away in the spare bedroom. That's one reaction to Compaq's striking new Presario 3000 system, with its flat-panel color display suspended against a speaker-grille backdrop. Another reaction: Is this really a personal computer?

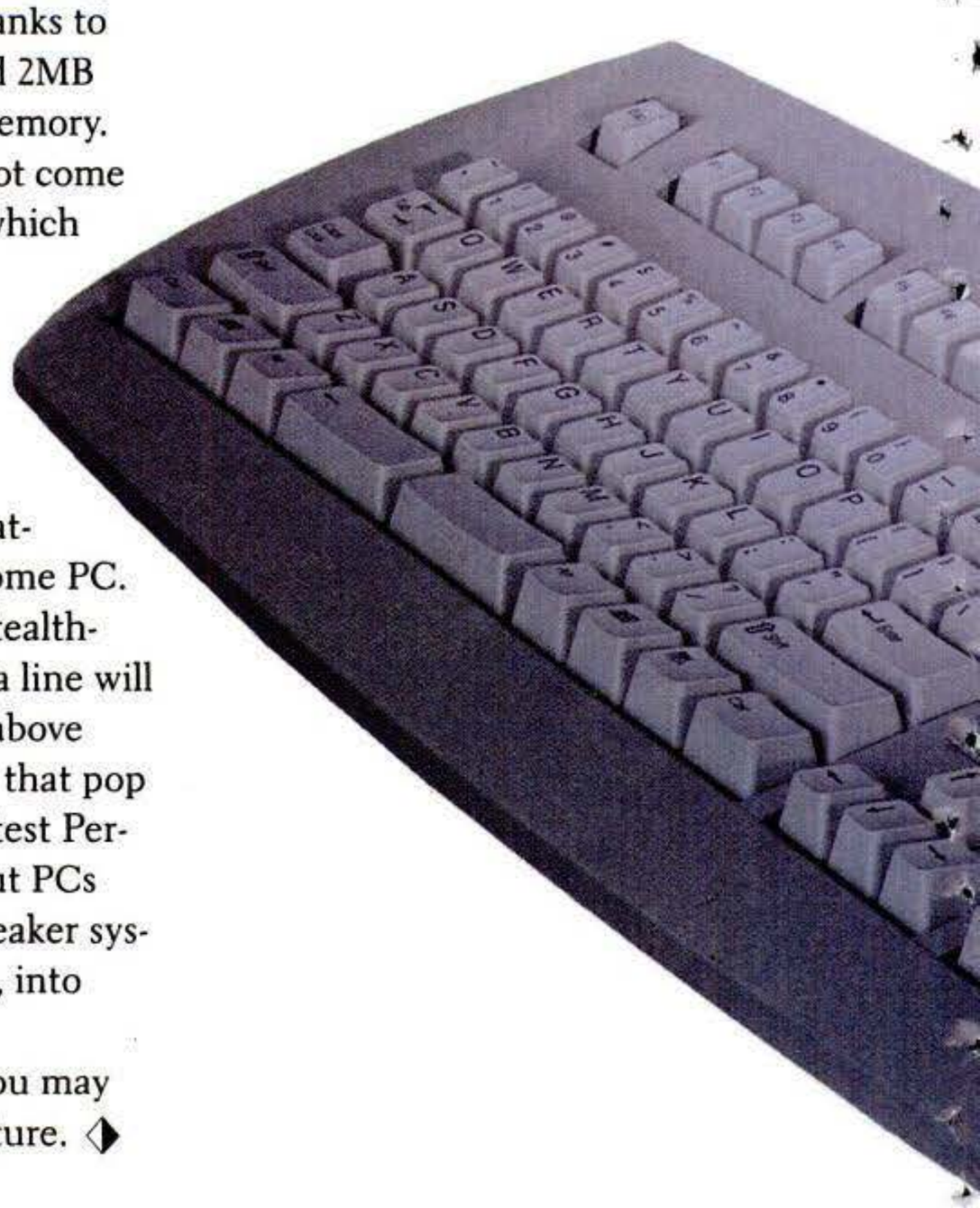
Yes, it's a PC, and a deceptively high-powered one at that. The first model in a new line, the Presario 3020 has a 166MHz Pentium processor inside, accompanied by 16 megabytes of memory, a 2-gigabyte hard disk, a 33.6 modem, a four-disc CD-ROM changer, and JBL stereo speakers with Spatializer surround-sound. There are even *four* expansion slots tucked horizontally in the rear.

But the sleek design is what really moves you—and moves with you. The Presario's slender shape, coupled with a built-in handle and holders for both the keyboard and cordless RF mouse, lets you quickly transport the PC from the family room to the kitchen. (You'll need an AC outlet, though; there's no battery operation.) And the 12-inch LCD screen is lustrous enough to work or play in any room, because of unusually bright dual-lamp backlighting. Video clips look remarkably smooth, thanks to MPEG software support and 2MB of high-speed videoboard memory.

Computer cachet does not come cheap. The Presario 3020, which comes preloaded with Windows 95 and a host of other software programs, is expected to sell for about $3,500, a hefty premium.

Compaq is not alone in attempting to redesign the home PC. Due in September, a new stealth-black model in IBM's Aptiva line will feature a monitor perched above floppy and CD-ROM drives that pop up from its base. Apple's latest Performa 6400 and Sony's debut PCs each integrate complete speaker systems, including subwoofers, into their hardware.

Heck, with these PCs, you may need to upgrade your furniture. ◆



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PHOTOGRAPHED BY JOHN B. CARNETT

Looking Sharp

The 12.1-inch (diagonal) color LCD screen is twice as bright as a typical laptop screen, and up to 60 percent brighter than desktop monitors. It also has a wide viewing angle and consumes only one-tenth the power of a CRT.

CDs on End

The vertically mounted CD-ROM drive lets you load up to four discs at once without caddies or trays. The CD Select button at the base of the unit lets you cycle through them, and they play at 8X speed.

Free-range Mouse

Using radio frequencies instead of infrared beams, the cordless mouse lets you roam freely.

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Big Job

INFOGRAPHIC BY JOHN GRIMWADE

CALL THEM TITAN TOOLS. Gorilla drills. Or, as one tool manufacturer prefers, "extreme cordless." However you say it, battery-powered tools are getting bigger and beefier. Indeed, some of the newest cordless tools make their corded counterparts seem tethered to the past, as well as to the outlet.

If you have $230, you can now buy a brawny 18-volt cordless drill/driver made by DeWalt. By the end of this year, you'll be able to choose from four brands of 14.4-volt drills. And for industrial work, you can even buy a cordless tool that drills into concrete with a whopping 24 volts.

In general, tools with higher voltages—12 volts and up—are designed to handle heavier work, such as drilling larger holes or turning bigger screws. Sometimes the extra power also means the batteries will last longer per charge, although that's not always the case. What you can count on is that higher-voltage tools weigh and cost significantly more. While manufacturers are scrambling to lessen these trade-offs, there's no magic solution on the technological horizon. It's up to you to decide what's handy, and what's heavy.

Introduced more than a decade ago, cordless tools are designed to be the convenient, go-anywhere alternative to conventional power tools. But the term "convenient" is relative: Using a cordless drill to fix your backyard fence may be easier than dragging out a conventional drill and multiple extension cords—but not if the battery's dead. Nor is a cordless tool handy if you're trying to drive a large lag bolt, and the tool doesn't have the oomph to turn it.

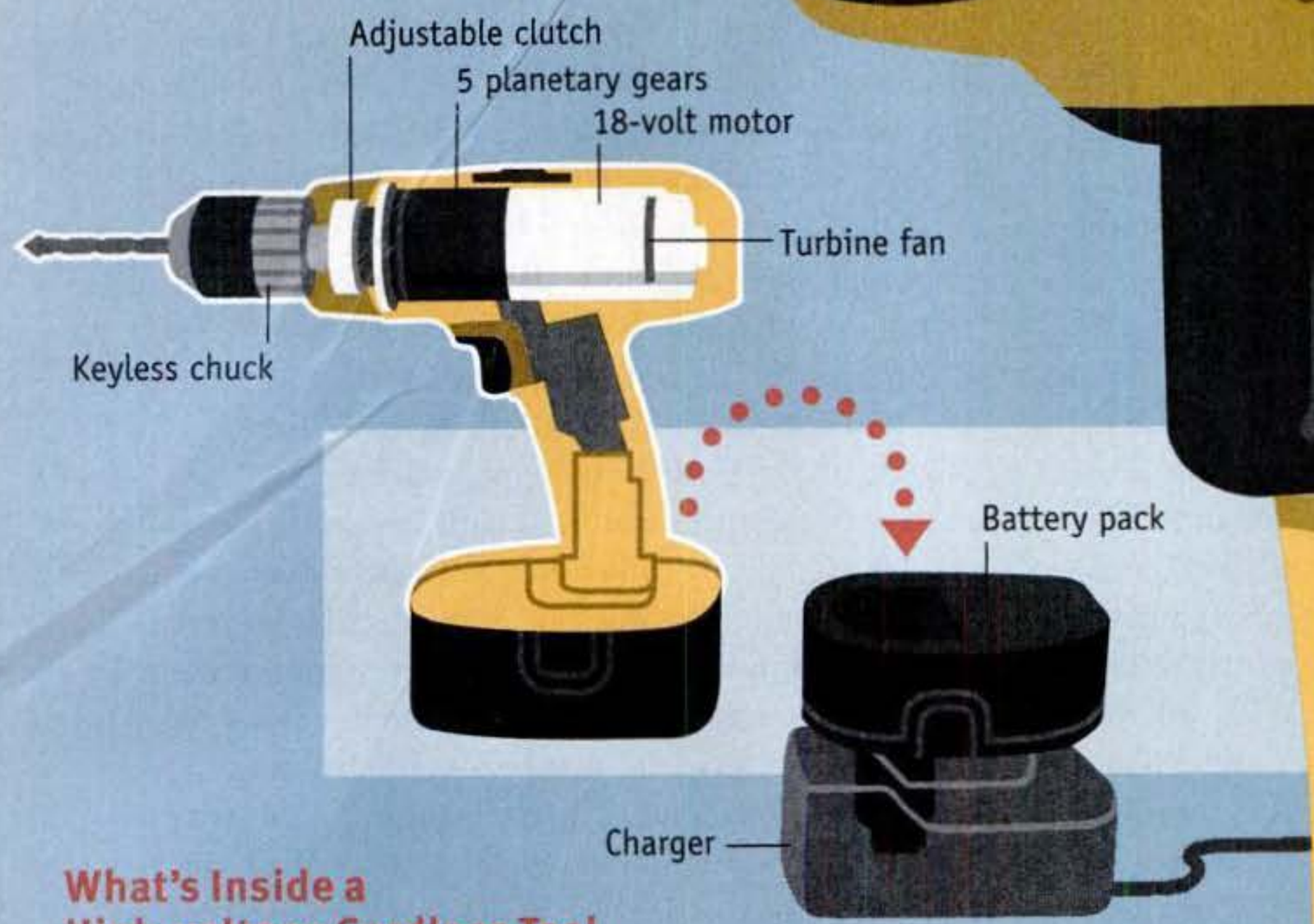
That's what makes the latest batch of cordless products so interesting: They enable you to tackle tasks that would have been unheard of a few years ago. The DeWalt 18-volt drill/driver, for example, can repeatedly send a 7/8-inch ship auger bit through a two-by-four stud. Cordless circular saws, which first appeared with blades so small they couldn't cut through two-by-fours, are now available with 5-3/8-inch blades—and can slice through those same studs more than 100 times before the battery needs recharging.

Not only are battery-powered tools getting bigger, they're also becoming more versatile. The tools most likely to succeed in cordless versions are those that are used for short intervals, and those that are normally carried around a worksite. For example, you may see a variety of new cutting tools—such as reciprocating saws and jigsaws—appear in cordless versions in the coming years (a few are already on the market). However, power-hungry equipment like sanders won't be going cordless anytime soon.

The newest cordless tools deliver more power than ever before. But with power comes a price.

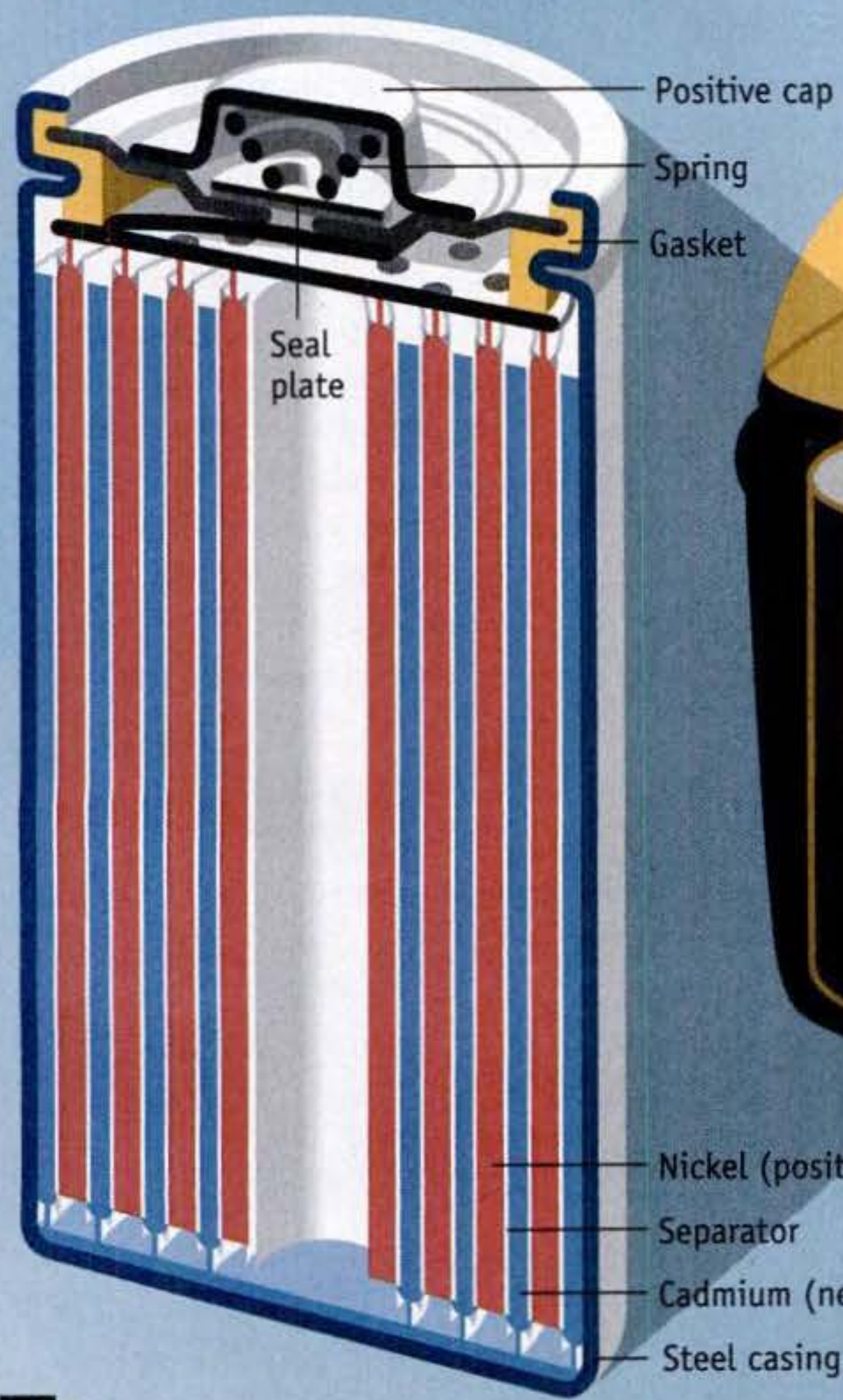
By Judith Anne Gunther

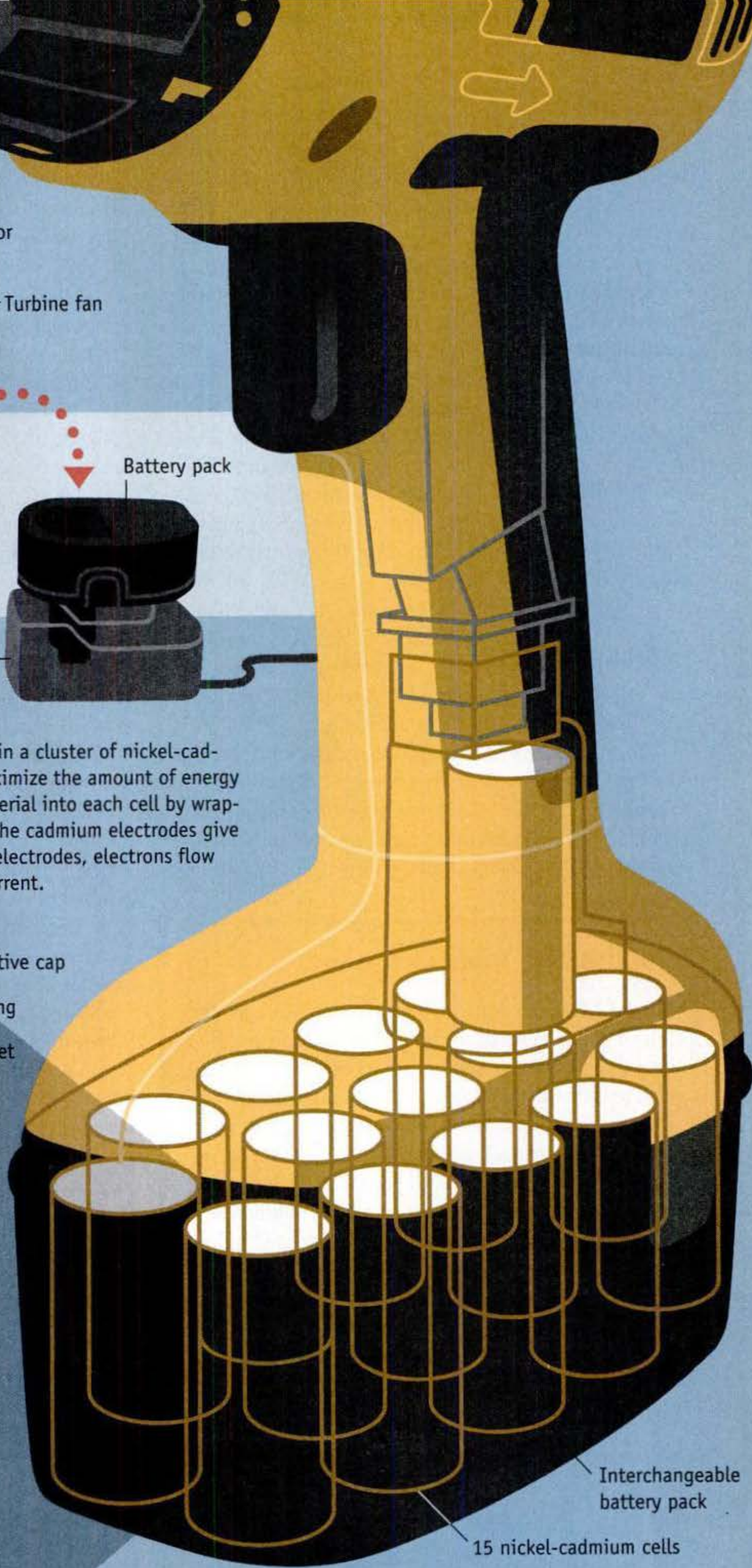
Improvements in nickel-cadmium batteries are the main reason why cordless tools are becoming more powerful. Nickel-cadmium battery cells are rated in two ways: the amount of power they pump out, measured in volts; and the length of time for which they do so, known as the capacity and measured in ampere-hours. "If you want to equate it to an automobile," explains Doug Bock of Panasonic's power tool divi-



What's Inside a High-voltage Cordless Tool

The battery packs of cordless power tools contain a cluster of nickel-cadmium cells; each cell produces 1.2 volts. To maximize the amount of energy produced, battery manufacturers pack more material into each cell by wrapping up the electrodes like a jellyroll. Because the cadmium electrodes give up their electrons more readily than the nickel electrodes, electrons flow from the cadmium to the nickel, producing a current.





sion, "voltage is kind of like horse-power, and capacity is equivalent to the size of the gas tank."

The amount of power a tool can deliver depends, then, on the voltage and capacity of its batteries, as well as the efficiency of its motor at converting electricity into work. A single nickel-cadmium (Ni-Cd) cell produces 1.2 volts; to jack up the voltage, multiple cells are stuffed into a tool's battery pack. Each extra cell adds about three ounces and several dollars to the product.

What does higher voltage achieve, in terms of performance? A 14.4-volt drill can deliver nearly twice the torque of a 9.6-volt drill. In our own informal tests, a 14.4-volt drill/driver sent a one-inch spade bit through an untreated pine two-by-four nearly eight times; a 9.6-volt drill drove the bit through the wood four and one-half times, and a 7.2-volt drill barely nicked the surface before bogging down.

But bigger isn't always better. Hefting a high-voltage tool can tire arm muscles quickly. A typical 9.6-volt drill tips the scales at somewhere between 3-1/2 and 4 pounds, while DeWalt's new 18-volt drill weighs 5-1/2 pounds.

In some drills, the handle is placed near the center to balance the weight. A 4-pound drill with this "T-handle" design feels more like three pounds. The drawback is that the T-handle doesn't position your hand directly behind the chuck and bit the way a conventional pistol-grip style does, making it more difficult to apply pressure with the tool.

Higher voltages also mean significantly more heat—not only from the chemical reactions within the extra battery cells, but also from the added work the motor can do. Among other things, high temperatures can interfere with the cells' ability to discharge, or to accept a new charge. For that reason, manufacturers sometimes add an air space between the cells and the shell of the battery pack. Another strategy for keeping cells cool is to find new ways to arrange them within the tool's battery pack or hollow handle.

In addition to the heat factor, higher-voltage tools need to be rugged enough to withstand the stress of the added power. Moving even from a 12-volt pack to a 14.4-volt one would warrant "going to a better gear train, because you're going to get more torque out of the tool," explains David Noggle of Skil-Bosch. Some manufacturers replace gears made of composite materials with steel ones, believing steel is more likely to weather the toughest workloads.

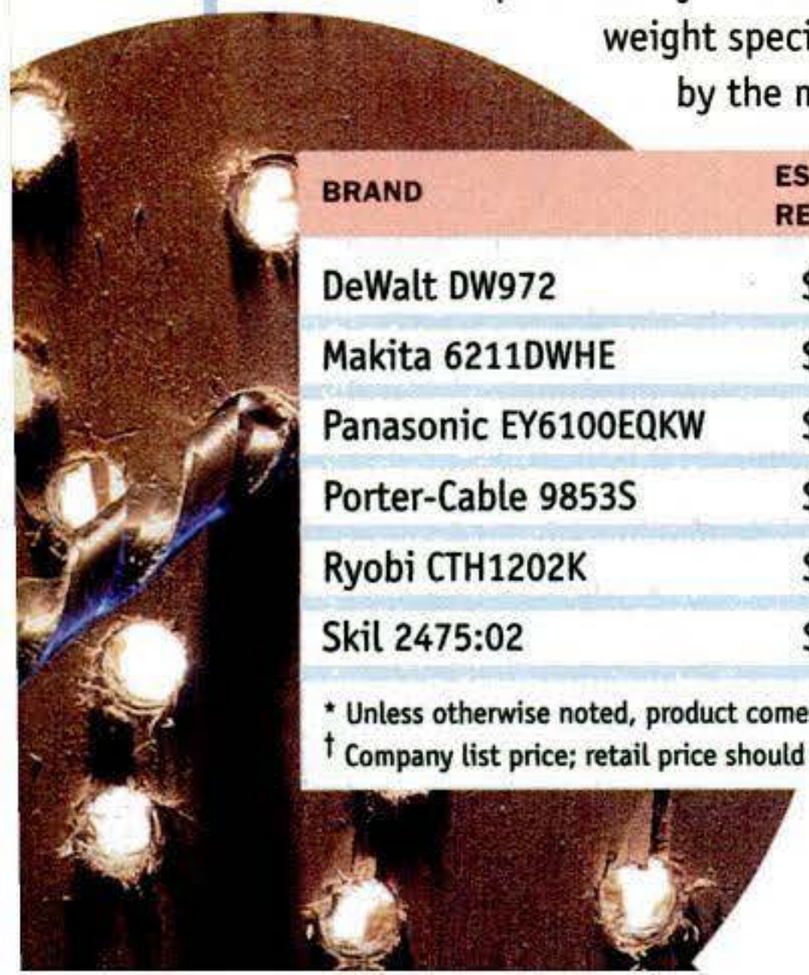
All of that torque won't be of much help, however, if your battery pack conks out after a few minutes' work. To boost run times, look for batteries with increased capacity. Ten years ago, a typical nickel-cadmium battery cell produced 1.2 ampere-hours. Today's conventional cells produce about 1.4 amp-hours, while most so-called "high-capacity" cells are rated at 1.7 amp-hours. And later this year, several manufacturers—including Makita, Panasonic, and Skil-Bosch—plan to introduce tools that use cells with 1.9 or more amp-hours. The difference can be significant. "When you go from a 1.2- to a 1.7-amp battery, now you have a 50 percent bigger 'gas tank,'" Panasonic's Bock explains.

To supplement a battery cell's capacity, more battery ingredients—in this case, nickel and cadmium—are crammed inside. To make room for the extra material, battery manufacturers must reduce the size of another component within the shell. One strategy is to make the cell's separators (the flexible plastic layers between electrodes) thinner. That, however, can leave the cell more prone to reduced performance or to damage—even meltdown—if the battery's internal temperature spikes too high during use or recharging. "When we tested 2-amp-hour cells in our lab, they performed about the same as the 1.7s," reports DeWalt's Chris Metz, "because as soon as you heat those cells up, run time goes way down." If the cells are damaged, the number of times they can be recharged may also drop off dramatically.

These drawbacks have encouraged tool designers to look

Putting the Tools to the Test

NOT ALL CORDLESS drills are created equal. Some are designed to deliver maximum torque, while others are designed to provide adequate power for light tasks over a long period of time. We tested six 12-volt, 3/8-inch cordless drill/drivers; before each test, the battery was fully charged, then allowed to cool. In the first trial, we ran the tool at full speed under no load until the battery drained. In the second trial, we used a 3/16-inch bit to drill as many holes as possible through untreated white pine two-by-fours. Torque, speed, and weight specifications were supplied by the manufacturers.



BRAND	ESTIMATED RETAIL PRICE*	TORQUE	MAX. SPEED (NO LOAD)	RUN TIME (NO LOAD)	# HOLES DRILLED	WEIGHT
DeWalt DW972	$ 362†	200 in.-lbs.	1,400 rpm	26 min.	324	4.2 lbs.
Makita 6211DWHE	$ 368	182 in.-lbs.	1,150 rpm	22 min.	292	3.7 lbs.
Panasonic EY6100EQKW	$ 229	174 in.-lbs.	1,300 rpm	27 min.	334	3.8 lbs.
Porter-Cable 9853S	$ 180	247 in.-lbs.	1,000 rpm	57 min.	387	4.5 lbs.
Ryobi CTH1202K	$ 139	188 in.-lbs.	1,000 rpm	59 min.	173	3.6 lbs.
Skil 2475:02	$ 79 **	90 in.-lbs.	700 rpm	36 min.	332	3.5 lbs.

* Unless otherwise noted, product comes as a kit, with two batteries, charger, and case
† Company list price; retail price should be less
** Comes with one battery, charger, and case

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at other battery types that are widely used in electronic products. But no one is likely to make the switch soon. For example, metal hydride batteries, used in laptop computers and portable phones, are designed to put out a small, steady flow of electricity; as configured, they cannot handle the sudden bursts of power that tools demand.

"Electrochemically, there is no reason why hydride batteries couldn't work in a high-drain-rate application," says David DeVries of Eveready. "But there are more practical reasons why they won't be widely used." Hydride batteries are significantly more expensive than Ni-Cds, as much as twice the cost. Most consumers probably wouldn't pay the higher price. (In Europe, where environmental concerns over the use of Ni-Cds are leading some manufacturers to use alternative types of batteries, hydride systems might appear in cordless tools.)

Lithium-ion batteries, another popular choice for portable products, can cost three times as much as comparable Ni-Cds. Lithium-ion cells also require more sophisticated recharging systems. For those reasons, Ni-Cd systems are destined to remain the power source of choice for cordless tools for the foreseeable future.

Will voltages continue to rise? Undoubtedly. Although consumers may reject drills that grow heavier than DeWalt's 5-1/2-pounder, they may not balk at an overweight circular saw if it's saddled with a 24-volt battery, because using the saw requires minimal lifting. And as long as professionals and serious do-it-yourselfers are willing to pay upward of $300 for a tool and spare battery, manufacturers will continue to respond with new high-voltage products.

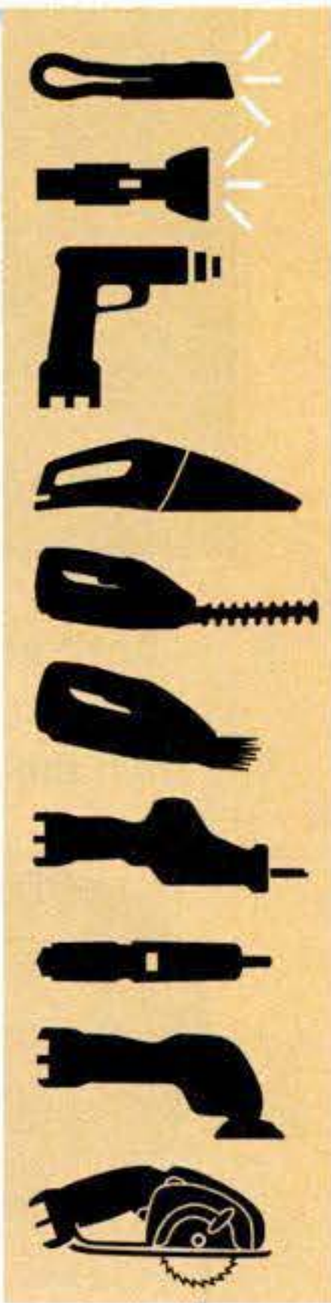
That leaves consumers gazing at store shelves stocked with battery-powered drills ranging from 6 to 18 volts, or possibly more—a bonanza for those who know which tool is sufficient for their requirements, and a quandary for those who don't. How do you choose a tool without paying—and lifting—too much? Some consumers simply gravitate toward the tool with the highest voltage. But that could be a waste of money, like buying a four-wheel-drive vehicle for a suburban commute. Voltage is only one indication of what a tool can do. "Power," or the amount of work a tool can deliver for a particular job, is a function of the entire tool design, including the capacity of the batteries and the quality of the motor.

For that reason, a tool's voltage is simply a good place to begin. Homeowners who don't want to sink a lot of money into cordless tools, and who would use a drill for jobs no more taxing than hanging window shades, should buy one with no more than 9.6 volts, and reserve occasional tough jobs for their corded tools. And to make less-powerful tools even more affordable, **some consumers may want to consider buying interchangeable batteries, such as the VersaPak series, which allow you to buy additional products without paying for additional cells.**

For most projects tackled by homeowners, a 9.6- or 12-volt cordless drill/driver will probably suffice. Leave the powerhouses—the drills with 14.4 volts and up—to the professionals, the most dedicated do-it-yourselfers, and those who can't resist the "bigger-is-better" mentality.

Beyond voltage, you may have to read the fine print on the box. Are the batteries labeled as high capacity? Did the manufacturer provide performance information? Companies like Ryobi, for example, specify the size of drill bits the tool can handle, or the number of cuts it can make on a charge. In the long run, knowing whether or not a product can drive 50 deck screws on a fresh battery may be of more use to you than a few more cells in your battery pack. ◆

BLACK & DECKER



One Size Fits All

CORDLESS TOOLS USUALLY cost more—often double the cost of an equivalent corded product. One way to help keep the price down is with a universal nickel-cadmium battery. This cylindrical 3.6-volt battery—Skil calls it Flexi-Charge, while Black & Decker calls it VersaPak—could soon find its way into every room of your house.

VersaPak batteries can already power a variety of Black & Decker shop tools and outdoor power tools, such as a weed trimmer and a leaf blower. Next may be household appliances, such as a cordless hand mixer. By the end of 1997, VersaPak products could number 50 or more.

While Black & Decker's batteries are not compatible with Skil products, they will be compatible with a new line of Craftsman products that will appear in Sears stores later this year.

What's the appeal? Price, primarily. Once you purchase one or two batteries, you don't need additional ones. That means you don't have to pay for batteries and a recharger each time you buy a VersaPak-type product. What's more, you need only one recharger to keep all of these products operating.—*J.A.G.*

A money-saving option: one cylindrical 3.6-volt battery fits many tools.

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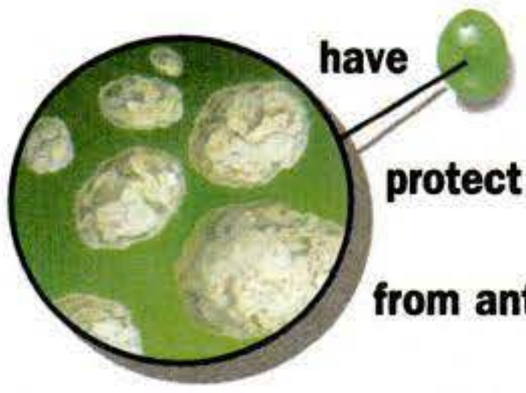
It protects your car from extreme heat, bitter cold and the harmful effects of regular antifreeze.

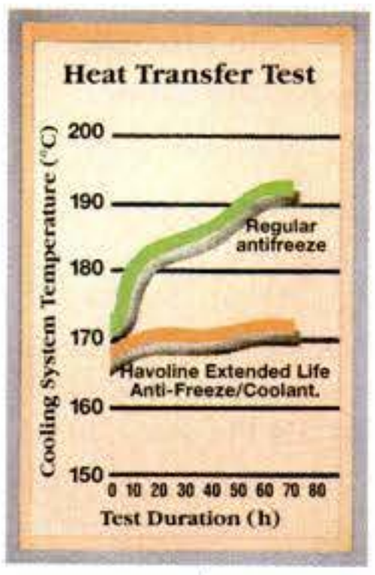
Antifreeze protects your car from the elements. Now all you have to do is protect your car from antifreeze.



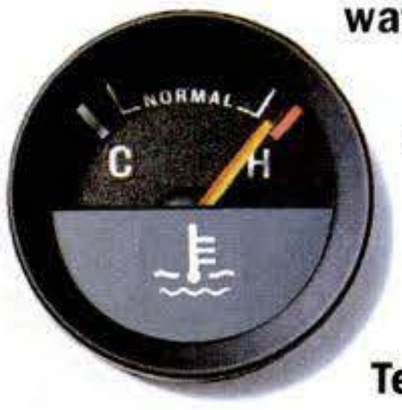
Silicate particles are microscopic. The damage they can do to your cooling system is anything but.

Conventional antifreeze is full of tiny, abrasive particles called silicates that wear on your water pump seals. Eventually, these particles can wear them out. The next thing you know, you're forking over a couple of hundred bucks for a brand new water pump. But not if you use our antifreeze. Texaco Havoline® Extended Life Anti-Freeze/Coolant.

Our antifreeze will help your cooling system keep its cool.



What's your car got to do to tell you you're using the wrong antifreeze?



It's a whole new kind of antifreeze. It has a revolutionary non-abrasive chemistry, without any silicates, so it cuts down wear. Just like regular antifreeze, it coats your radiator to help fight corrosion. But our coating is thinner — to improve heat transfer: so your cooling system cools better. And with all this, Havoline Extended Life Anti-Freeze/Coolant still costs about the same as regular antifreeze. No wonder General Motors puts it in virtually all their cars. It also meets Japanese car manufacturers' silicate-free requirements. Not to mention phosphate-free standards for European cars. But then, wouldn't you expect an antifreeze like this from Texaco? The same people who brought you Havoline Formula 3® motor oil and CleanSystem 3® gasolines. Which means the next time you change your antifreeze, it's time to change to ours.

This revolutionary new antifreeze can make your entire cooling system last longer.

Water pumps don't always die a natural death, silicates can kill them.

Havoline
EXTENDED LIFE
Anti-Freeze/Coolant

ADD MORE LIFE TO YOUR CAR
TAKE IT TO THE STAR™

Available at: Western Auto/Parts America, Pep Boys, Auto Parts Club, DAPS Auto Parts, Carport Auto Parts, Fay's Drugs, National Auto Stores, Strauss Discount Auto, Hardware Hank Hardware Stores, Our Own Hardware Stores, How To Hardware Stores and Cenex Petroleum Retailers. ©1996 Texaco Lubricants Co.

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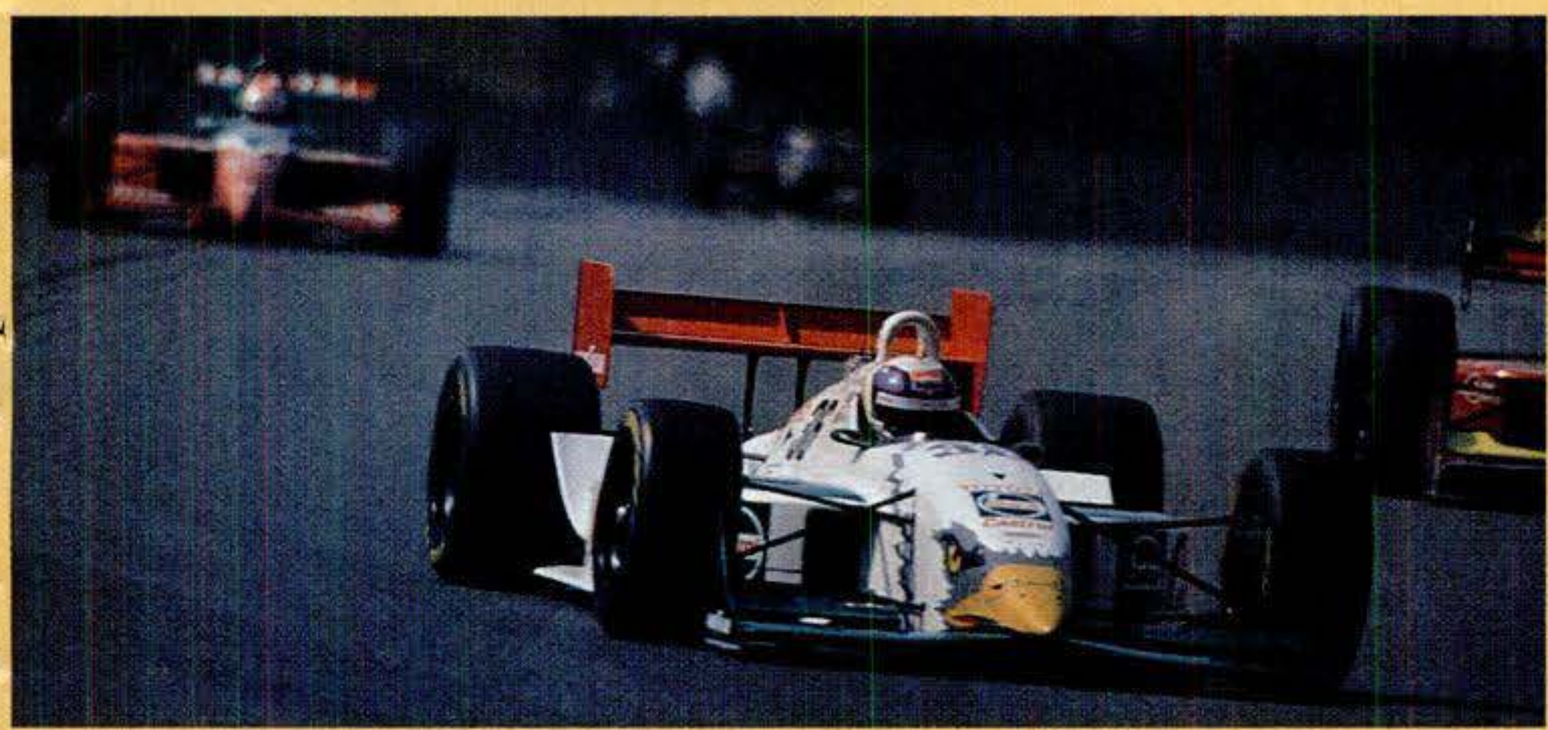
INDY CAR 96 A RACE TO THE FINISH



Forget baseball. When it comes to our "national pastime," just add up all the Indy Car, stock car, sports car, funny car, dragster and supertruck races run this season, and you could make a convincing case that auto racing is becoming the flat-out favorite spectator sport in the country. And the leader of this pack of action—in terms of speed, technology and pure racing excitement—is the PPG Indy Car World Series.

Indy Car is a 16-city, 4-country annual season of races from March through September, stretching from Brazil to Australia to Canada to the U.S. The races are run on an ever-challenging, ever-changing variety of tracks that include high-speed ovals, short banked speedways, picturesque hill-and-dale road courses, and even temporary street courses through major cities.

Although the tracks may change, every race matches the same drivers and superhigh-performance vehicles—open-wheel, open-cockpit, purpose-built racing machines that generate 800-plus horsepower with engines no bigger than a suitcase, capable of speeds in excess of 240 miles per hour.

Now the 1996 Indy Car season is racing toward its three final, decisive races (see Down To The Wire, page 78). But there's still plenty of track ahead before this year's champion rolls into the Winner's Circle at Laguna Seca in September. As team owner Barry Green observed, "This is just another great season. It's anyone's championship yet."

A TEAM EFFORT

If it's fame you crave, keep your eye on the drivers. But if you're looking for real racing excitement, real fight-to-the-finish-line drama, check out the guys in the pits with the headphones and the tightly clenched jaw muscles. They're the brains and the brawn behind all of this automotive action. The master technicians. The trackside generals. They're the race team, and they're out there to win just as much—if not more—as the men behind the wheel.

So who are these guys, and how did they get here, anyway?

Indy Car represents the pinnacle of auto racing in the United States, with vehicles that utilize the highest level of technology to produce the highest attainable speeds. A team must be capable of not only performing but excelling in this rarified atmosphere just to compete for one of the coveted pit positions.

"You absolutely must be fast enough," says Barry Green, whose Team Green won the championship last year. "In the last race, we were just six-tenths of a second off the pole position time, and we found ourselves way down in the grid." Yet Green emphasizes that as long as you've got the goods—which generally means a car that can run flat-out at 235 mph for a sustained 500 miles or so—you can vie for a slot.

By Michael Morris

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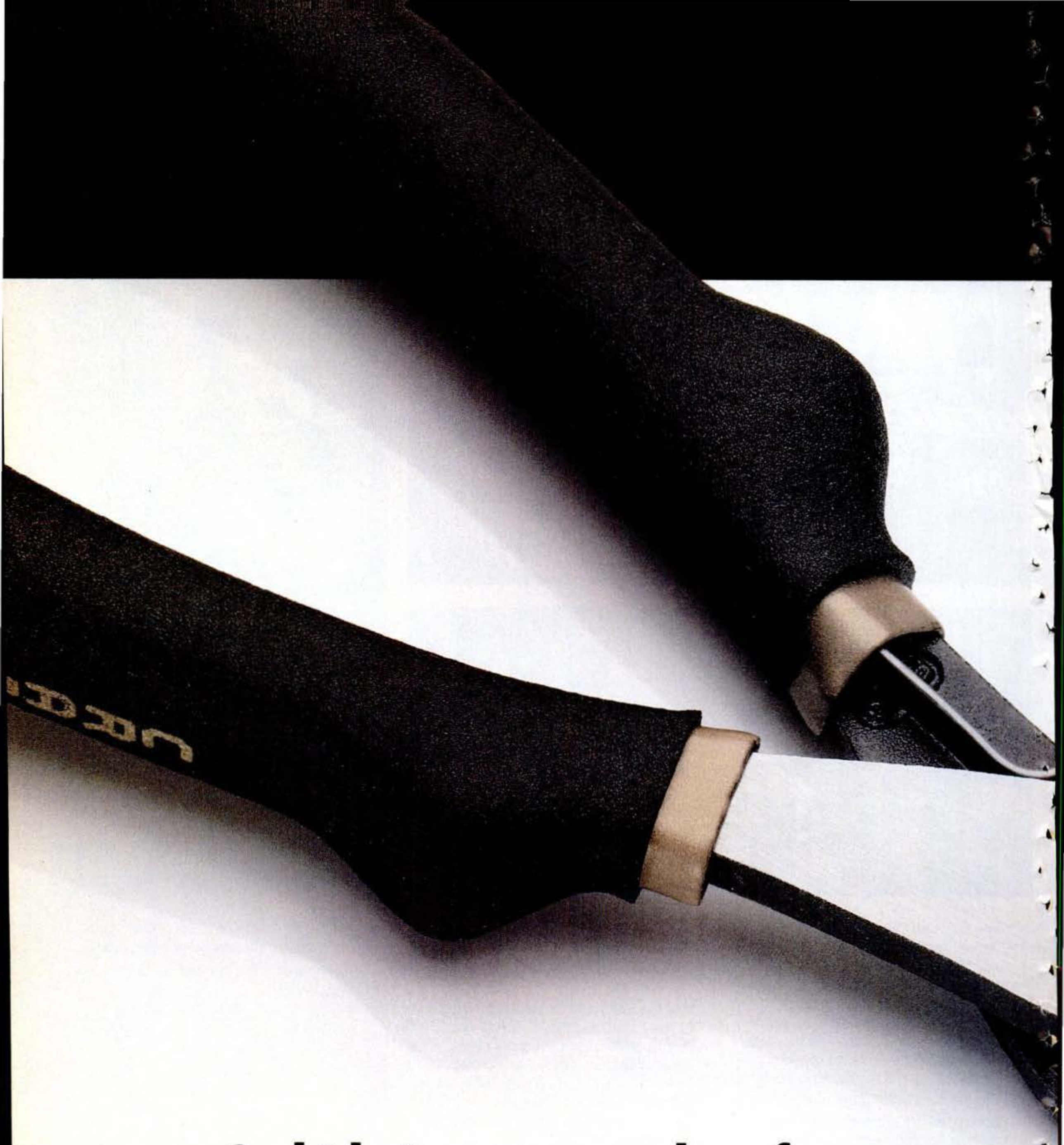

Carbide impregnated surface stays sharper 50% longer.

*3-Piece Set #45129 includes: 7" wide-jaw diagonal, 9 1/2" arc-joint and 8" long-nose pliers; $39.99 plus $5.95 shipping

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Create the world's sharpest, most comfortable pliers ever.

Always improving. These finest-quality Craftsman pliers have tungsten carbide impregnated cutting blades, providing longer wear resistance and edge sharpness.

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Squeeze after squeeze, the new Craftsman grip never fatigues your hands.

Like over 2,200 other Craftsman hand tools, these innovative new pliers are made in America, guaranteed forever. Only Craftsman has this unique, 7" diagonal cutter with finger activated spring-loaded design. And because Craftsman pliers are clear-coated, they resist rust and corrosion for as long as you use them.

This new Craftsman 3-piece professional plier set is just 39.99*, that's a $60 value if purchased separately. You'll find them and many more outstanding Craftsman innovations at your local Sears and Sears Hardware Stores and in the Craftsman Power and Hand Tool Catalog (offer code #801342). Call the toll-free number below for your free copy, or to order your own set of Craftsman pliers right now, delivered direct to you.

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Of course, it's not even that easy. Because the cost of this effort runs upwards of $8 million for each team, each season, it's little wonder that the names of major corporate sponsors are highly visible on the cars. In 1997, Green will partner with a new sponsor, KOOL, which is itself stepping up to the major leagues of racing after one season in Indy Lights, an open-cockpit racing series similar to Indy Car where many drivers and teams develop.

But it's individuals, not sponsors, who own and organize the teams. Often they're former racing drivers like competitors Roger Penske and actor Paul Newman. Green himself raced in Formula-series cars here and in his native Australia before moving to team management. Most Indy Car teams include three to four dozen people, from rear-office support staff to road crews to pit mechanics and technicians. Although each member is a top-notch specialist in his field, many teams cross-train their people to help out in other capacities before and during races.

"It takes very dedicated people," says another team owner, Derrick Walker. "You may think the competition is only on the track among the drivers, but everyone else in the team—everyone involved—is just as competitive."

IN THE PITS

Old-time race fans could tell you: If you wanted to see gritty, behind-the-scenes action during an auto race, you had to get down and dirty in the pits.

Well, Pit Lane is still the scene of fast and furious action, but it has changed. For one thing, it's no longer dirty. Race crews have learned that cleanliness is next to speediness, and grime-free pits are safe and productive workplaces—an important consideration when every second counts. And today when an Indy Car roars in for a scheduled or emergency stop, the first mechanic to reach its side is more likely to be holding a shiny new laptop computer than a lug wrench. Although a tire change and refueling in under 10 seconds can take a race fan's breath away, a quick data download from the car's array of electronic sensors just as often decides who crosses the finish line first.

Despite these changes, the pit crews' essential responsibility remains the same. In the early days of auto racing, many cars had two seats—one for the driver, and the other for his on-board mechanic. Nowadays, "data mechanics" are even closer to the car, in a manner of speaking. "You can't just rely on information from the driver anymore—the cars are much too sophisticated," explains one crew chief. "These cars have electronic 'black boxes' that store information, just like an aircraft. They tell us how the car is running, how it rolls, how the fuel is being used, what changes we made to the car are doing to the way the car performs. And not all of the data is stored. A lot of it, particularly engine data, comes over as telemetry" as on-board sensors transmit their information directly to the pits.

Another contrast between racing's present and past can be seen in the mechanics' tool kits.

SPECIAL ADVERTISING SECTION

On Track, On-Line

RACING INFORMATION

Indy Car News
internet motorsport'96@aol.com
website http://www.indycar.com

IndyCar Winners Circle Club
website http://www.indycar.com/mall/wcclub/WinnersCircleClub.html

ICR Interactive
Indy Car Racing Magazine
website http://www.icr.com

ESPN Sports Zone
website http://espn.sportszone.com

Popular Science Magazine
website http://www.popsci.com

Speednet
website http://www.starnews.com/speednet

The Global Racing Network
website http://www.mis.net/grn

TRACKS AND TEAMS

Concord Pacific Place, Vancouver, BC
website http://www.indy-vcr.molson.com/molson.com

Laguna Seca Raceway, Monterey, CA
website http://www.laguna-seca.com

Road America, Elkhart lake, WI
internet ra@dataplusnet.com
website http://www.dataplusnet.com/ra.html

Team KOOL Green
website http://www.speednet-pro.com

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Box 100's: 16 mg. "tar", 1.2 mg. nicotine av. per cigarette by FTC method.

Although the technology has increased dramatically, the cars themselves have become easier to service. In the early days of motoring, before standardization set in, mechanics often had to fashion their own tools or rig equipment just to keep up with the rapid pace of automotive development.

Now, according to Andy Ginger of Craftsman Hand Tools, the official tool of Indy Car and a sponsor of the Walker Racing team, mechanics still occasionally adapt or even invent tools for special tasks. "But in most cases we can provide what they need right off the product line. You could pick the same tool out of the catalog today and have it in your garage tomorrow."

FROM RACE CAR TO YOUR CAR

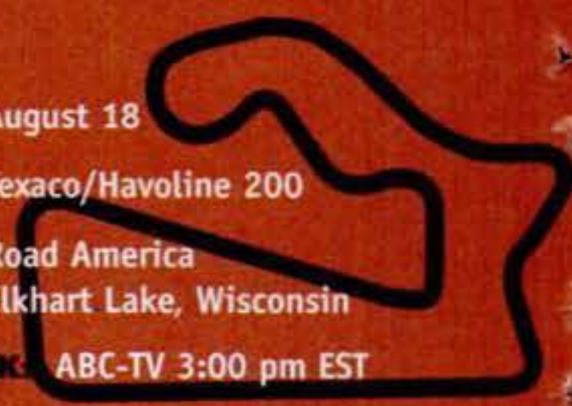
Whether you realize it or not, every time you get in your car, buckle your seat belt, turn on the engine and roll down the driveway, you're benefiting from racing technology. In fact, race-proven products like engines, tires, mechanical components, fuels and fluids are constantly pushing the limits of automotive capability—all the way to your garage.

Take seat belts, for example. Passenger cars have them today because in the early days of road racing—when dirt roads and dirt tracks were all that was available—drivers found they needed something just to keep themselves in their seats. Belts evolved to passenger cars via sports cars, which were often used off-track when they weren't racing. It's interesting to note that lap belts were introduced to the driving public as accessory items, to give cars a "sporty" look. Only later were they recognized for their safety value.

Today, a clear connection between track and street can be seen where the rubber meets the road. According to Tony Troiano, manager of Firestone Racing's Indy Car tire program, "There's a great amount of technology-transfer from racing. What we learn on the track is what you ultimately get when you buy tires for your car." One passenger-car performance tire recently introduced by the company, the Firehawk SZ50, has a tread pattern initially designed for Indy Car tires. Many street tires also share tire-composition breakthroughs developed and tested in competition.

SPECIAL ADVERTISING SECTION

Down To The Wire!



DATE: August 18

RACE: Texaco/Havoline 200

TRACK: Road America
Elkhart Lake, Wisconsin

NETWORK: ABC-TV 3:00 pm EST

TICKETS: 800/264-RACE

What to watch: Passing duels on three long, fast straightaways, blazing corners, and an uphill climb pit row.

DATE: September 1

RACE: Molson Indy Vancouver

TRACK: Concord Pacific Place
Vancouver, B.C.

NETWORK: ESPN 5:00pm EST

TICKETS: 604/280-INDY

What to watch: Beautiful downtown Vancouver isn't known for it's mean streets–until this race rolls through town.

DATE: September 8

RACE: Toyota Grand Prix of Monterey

TRACK: Laguna Seca Raceway
Monterey, CA

NETWORK: ESPN 3:00pm EST

TICKETS: 800/327-7322

What to watch: Lots of tight cornering through wooded hillside turns, screaming mountain straightaways and the legendary Corkscrew.

But what goes around comes around, and competition in a different arena—the consumer marketplace—has brought the wheel of automotive technology full circle: Today there are off-the-shelf products available for the family car that are so capable, they are routinely used in racing. Havoline Formula 3 motor oil is a prime example. "It's a pretty remarkable product," says Lee White, manager of the Newman/Haas Racing team, which is sponsored by Texaco/Havoline. "We use it in the shop and on the track—in engines putting out 850 horsepower at extremely high temperatures for hours at a time—and we've never had an oil-related failure."

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TECHNOLOGY UPDATE

Fifteen years of microelectronic research makes conventional antennas a thing of the past!

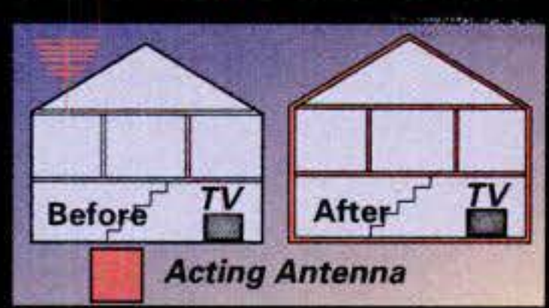
This little box uses your home's electrical wiring to give non-subscribers, cable subscribers and satellite users better TV reception!

Technology corner

1. Why don't conventional antennas work as well as the Spectrum?

- When TV signals are tuned at the TV channel's center frequency, optimum tuning has been achieved.
- Other antennas can't offer center frequency tuning like the Spectrum Antenna can. They only offer such tuning up to the edge of the center frequency. As a result your TV picture remains snowy.

2. How does Spectrum use a home's electrical wiring as an antenna?



Believe it or not, the Spectrum Antenna simply "activates" the giant antenna that already exists in your home. Essentially, it uses all of the wiring throughout your home's walls and ceilings to make an antenna as large as your house for unbelievably clear reception of local broadcasting.

3. Spectrum antenna features

Parallel 75 ohm resistance
For minimum loss of signal

Signal search control
For selecting multiple antenna configurations

Polarized three-prong plug for grounding
For optimum signal grounding to eliminate noise and static

Resonant fine tuner control
For dialing in crisp, clear TV/stereo reception eliminates ghosting

Dual AC outlets with built-in surge protection
For plugging in additional TV/stereo equipment guarding against damage and electrical surges

Until recently, the only convenient way to guarantee great TV reception was to have cable installed or place an antenna on top of your TV. But who wants to pay a monthly cable fee just to get clear reception, or have rabbit-ear antennas that just don't work on all stations? Some people just aren't interested in subscribing to cable. Or they may live in an area where they can't get cable and TV-top antennas aren't powerful enough. And what about those people who have cable or satellite systems but still can't get certain local stations in clearly?

Now, thanks to fifteen years of microelectronics research, a new device has been developed that is so advanced, it actually makes conventional antennas a thing of the past. It's called the Spectrum Universal Antenna/Tuner.

Advanced technology. Just imagine watching TV and seeing a picture so clear that you'd almost swear you were there live. Just plug the Spectrum Antenna into a standard AC outlet and plug your TV into the Spectrum. You can remove the unsightly clutter of traditional TV-top devices gathering more dust than television signals. Get ready for great reception. Your TV will suddenly display a sharp, focused picture thanks to its advanced design "Signal Search" and "Fine Tuner" controls.

Who can use Spectrum?

- *Cable users-**You have cable but you can't get certain local stations in clearly.***
- *Non-cable users-**You don't have cable and want the stations to come in more clearly***
- *Satellite users-**You have a digital satellite system but can't get local stations in clearly***

Uses your home's electrical wiring. The Spectrum Antenna is a highly sophisticated electronic device that connects into a standard wall outlet. The outlet interfaces the Spectrum Antenna with the huge antenna that is your home wiring network. It takes the electrical wiring in your house or apartment and turns it into a multi-tunable, giant TV reception station which will improve your TV's overall tuning capability. The results are incredible. Just think how much power runs through your home's AC wiring system—all that power will be used to receive your local broadcasting signals.

How it works. Broadcast TV signals are sent out from the local broadcast station (ABC, CBS, NBC, etc.). They interface with your home's AC power line system, a huge aerial antenna network of wiring as large as your home itself. When the Spectrum Antenna interfaces with the AC line, the signal is sent to its signal processing circuit. It then processes and separates the signal into 12 of the best antenna configurations. These specially processed signals route themselves into 12 separate circuits. The Spectrum Antenna includes a 12-position rotary tapping switch, the "Signal Switch" control, which gathers twelve of the best antenna configurations.

The "Signal Search" offers varying antenna configurations for the user to select from the best signals of all those being sent. The signal then passes through the Spectrum Antenna's special "Fine Tuner" circuit for producing crisp, clear reception.

Risk-free offer. The Spectrum Universal Antenna/Tuner comes with our exclusive 90-day risk-free home trial and a 90-day manufacturer's warranty. Try it, and if you're not satisfied, return it for a full "No Questions Asked" refund.

Limited time offer! We realize that most people have more than one TV in their home. We are offering a special discount on additional Spectrum Antennas so you get great reception on all your TVs!

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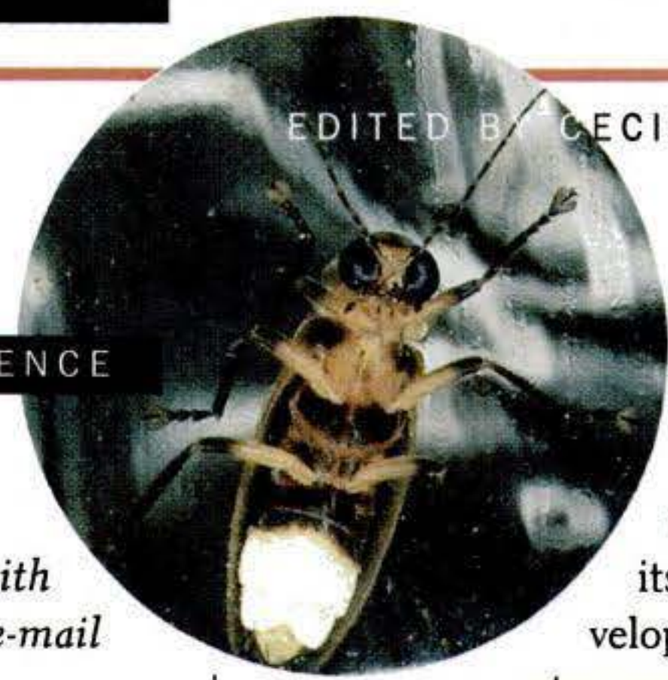


J. E. LLOYD/ANIMALS ANIMALS

ASK POPULAR SCIENCE

How and why do fireflies light up?

Doug Smith
via e-mail

FIREFLIES ARE not flies, but beetles. Worldwide, there are roughly 2,000 species of beetles that emit light, which can range in color from orange to yellow to green.

All such beetles generate light in a similar fashion. Inside cells called photocytes, the enzyme luciferase combines with another chemical called luciferin. The resulting compound, oxyluciferin, is the source of the luminescence. Depending on the insect and its stage of development, photocytes can be found in the thorax, thorax and head, or throughout the body.

According to Dr. James Lloyd, professor of entomology at the University of Florida, fireflies use their lights to attract a mate. In the most common fireflies, known as lightning bugs, a male signals to the female, who typically responds with a single light pulse. Researchers believe the female is selecting for a mate that can find his way to her with just a single pulse of light to guide him.

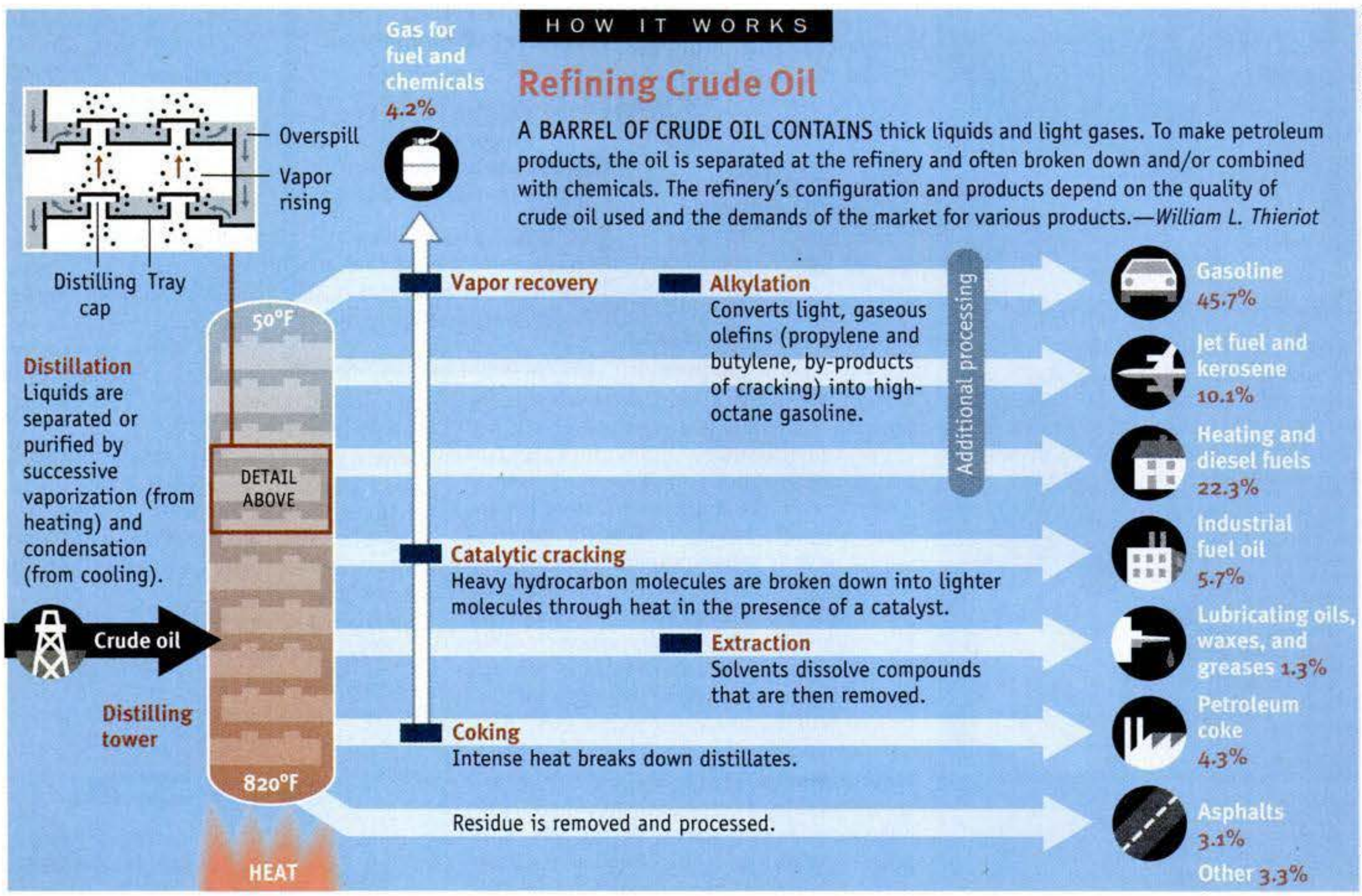
But fireflies also light up for less romantic purposes. Some females of the Photuris species, for example, mimic the signals of females of the Photinis species in order to steal Photinis males. This "firefly femme fatale," says Dr. Thomas Eisner of Cornell University, not only attracts Photinis males, but eats them. By doing so, the Photuris female absorbs the males' toxic steroids and becomes "distasteful" to predators, such as the jumping spider, who reject Photuris females immediately if they taste the poison.

JOHN GRIMWADE

HOW IT WORKS

Refining Crude Oil

A BARREL OF CRUDE OIL CONTAINS thick liquids and light gases. To make petroleum products, the oil is separated at the refinery and often broken down and/or combined with chemicals. The refinery's configuration and products depend on the quality of crude oil used and the demands of the market for various products.—*William L. Thieriot*



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What are the so-called "flesh eating bacteria?"

NessaDraco@eworld.com

GROUP A Streptococcus bacteria are known to cause many human infections, including the notorious strep throat. But they can reside in the human throat without causing any symptoms, says Dr. Vincent Fichetti of the Laboratory of Bacterial Pathogenesis at Rockefeller University. Why some people get strep throat and others don't is uncertain.

These bacteria can sometimes produce any of three different toxins. If toxin-producing bacteria invade an open wound, the toxin can break down fat and muscle tissue, a condition known as necrotizing fasciitis, popularly called "flesh eating." Group A Streptococcus bacteria are transmitted mainly through respiratory fluids and contact with secretions from wounds. Proper wound treatment and antibiotics can prevent severe infection.

Approximately 10,000 to 15,000 cases of severe Streptococcus infections are reported in the United States each year, says Tom Skinner of the Centers for Disease Control and Prevention. Of these, about 1,500 result in necrotizing fasciitis. But that's not necessarily shocking news. According to Dr. Daniel Musher, head of infectious diseases at Houston Veterans' Hospital and the Baylor College of Medicine, "In a country with 261 million people, 1,500 cases is not a remarkable number. Many of the cases occur in persons who have a poor blood supply, and whose immune responses have been diminished. Our data do not show an increase in the number of cases of infection due to Group A Streptococcus during the last 10 years."

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What is blood plasma?

D.W.
via e-mail

BLOOD HAS TWO main components. Forty percent is comprised of cells: red blood cells, white blood cells, and platelets. The remaining 60 percent consists of a solution of water, salt, potassium, magnesium, and calcium—a liquid known as plasma. Plasma also carries a variety of molecules, including hormones, globulins, and proteins that help blood to clot.

According to Dr. Mark Udden, associate professor at the Baylor College of Medicine in Houston, blood transfusions usually require

CRAB SPIDER BY JONATHAN CODDINGTON / THE FIELD MUSEUM

THE FACTS

Come into My Parlor

WHEREVER YOU ARE, you're never more than three feet from a spider. Scary. Actually, spiders are generally harmless to humans, and they play an important role in controlling insect pests. But whether you find spiders to be worthwhile or worrisome, they are wondrous creatures.
—*compiled by Mariette DiChristina*

The word spider comes from the Old English verb "spinnen," or "to spin."

Some 34,000 species of spiders are known to exist, compared with 4,600 known species of mammals.

Spiders are arachnids, which have eight legs and two distinct body parts—a cephalothorax (prosoma) and an abdomen (opisthosoma). The cephalothorax, which combines head and thorax, has six pairs of appendages: the jaws (chelicerae), a pair of pedipalps to grab prey, and four pairs of walking legs. Other members in the family Arachnida include scorpions, mites, and ticks.

Like insects, spiders have a protective hard body shell, or exoskeleton. They grow by shedding these exoskeletons two to 14 times before maturity. Unlike insects, they have no antennae.

While spiders may have as many as eight simple eyes, arranged in two groups, they don't rely on vision for input about their surroundings. Instead, the fine hairs that cover their bodies help spiders taste and feel vibrations, such as prey rattling a web.

A spider's muscles can curl its legs. But to straighten their legs, spiders have to pump fluids into them. If the spider hasn't gotten enough water, its legs will curl up and cannot be straightened.

All spiders have fangs and poison for capturing prey. But only six North American spiders have a bite that can harm humans. They are four widows (black, brown, red-legged, and varied), the brown recluse, and the sack spider widow. All except the black widow and brown recluse are rare.

Spiders are the only animals that digest their food outside their bodies. They vomit over the prey with digestive enzymes, wait for the enzymes to break down body tissues, and then suck up the nutritious liquid. By doing this several times, the spider can eat the whole insect.

All spiders have silk glands and spinning organs called spinnerets. The silks are liquid inside the gland but become solid as they are drawn out of the spider, because this action reorients the silk molecules. Many spiders, called orb weavers, create webs to catch prey. Spiders also use silk to wrap captured insects, protect eggs, and make nests or line burrows. Some spiders spin webs into a sticky ball that they throw at prey.

Spider silks are made of fibrous and amorphous proteins. Linear chains of molecules, the fibrous proteins can make silks stronger than steel piano wire. Amorphous proteins, with molecular chains folded into complex shapes, make those silks more elastic than rubber or any other synthetic material. Some spiders may make several webs in a day; they eat the old webs to recycle the silk.

Some spiders have elaborate courtship rituals in which the male may wrap the female in some silk, or "dance" in a series of complex steps. Males who are lucky in love can be unlucky at the same time: In some species, the females, which are larger than the males, may eat the males during copulation.

Early Greeks used cobweb compresses to staunch blood flow—spiders' webs discourage infection; today, researchers at the University of Wyoming are trying to create sutures from the silk of a Golden Orb spider.

During World War II, special spider farms were set up. At the time, spider silk was used in crosshairs for gun sights, telescopes, microscopes, and other optical instruments.

The *Theraphosa leblondi* spider from South America has a body the size of a large pancake—with a 10-inch leg span. These spiders have been known to eat small birds.

The smallest spiders are the *Patu marplesi* of Western Samoa in the Pacific. They are the size of the period at the end of this sentence.

The fastest spiders, sun spiders that live in arid regions of Africa and the Middle East, can top 10 mph.

A traveling exhibit organized by the National Museum of Natural History in Washington, D.C., called "Spiders!", will run in Detroit and Toronto (Oct. 21), then to Boston, San Francisco, Honolulu, and Cincinnati in 1997.

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only certain parts of the blood; rarely is whole blood used. For example, a patient suffering from anemia needs red blood cells, not whole blood. A patient with an impaired immune system may need just globulins. Transfusions are tailored specifically for a patient's needs.

Some patients, such as those with severe liver disease, cannot make the proteins needed for normal clotting. These patients will often improve with transfusions of fresh plasma.

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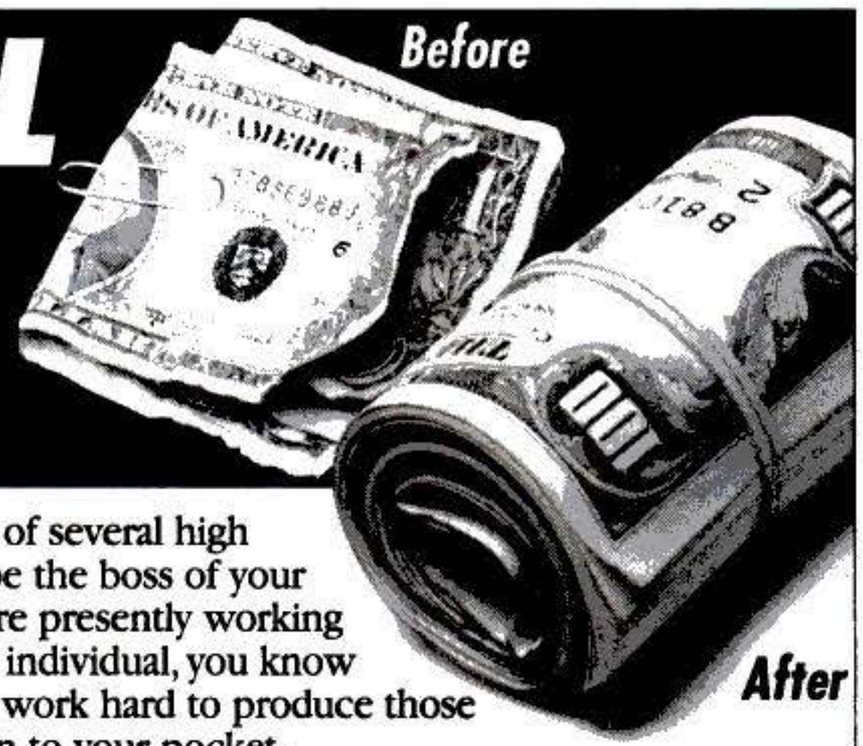

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What exactly is ISDN and how can we use it?

middltas@transend.com.tw

SHORT FOR Integrated Services Digital Network, ISDN is a digital telephone network that allows you to transmit data, voice, and images over one phone line simultaneously. With ISDN, you don't need two separate phone lines—one for voice and one for data. ISDN needs only one line because the digital network has a much higher data capacity and is much faster than current analog systems. ISDN is of great benefit to anyone who needs to send information back and forth over the phone while carrying on a phone conversation—for example, a doctor can transmit a patient's file to a specialist while discussing the patient's general condition.

But an ISDN line doesn't come cheaply. First, your phone company must install it, which can cost up to $200. And monthly connection fees can be as much as $100 or more, depending upon the phone company used. You'll also need an ISDN modem, which can cost anywhere from $300 to $400.

Because of the high quality of the digital signal and its speedy access times, ISDN is a favorite of heavy Internet users. Internet service providers generally charge hefty fees for ISDN access, however—up to $500 per month is not uncommon.

What happens in your head during a headache?

KBB101@aol.com

THAT DEPENDS on what type of headache you have. The two most common types are tension and migraine. In both cases, pain results from the stimulation of nerve endings. The difference is the source of stimulation.

During a tension headache, scalp and neck muscles contract, stimu-

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Is yogurt a solid or a liquid?

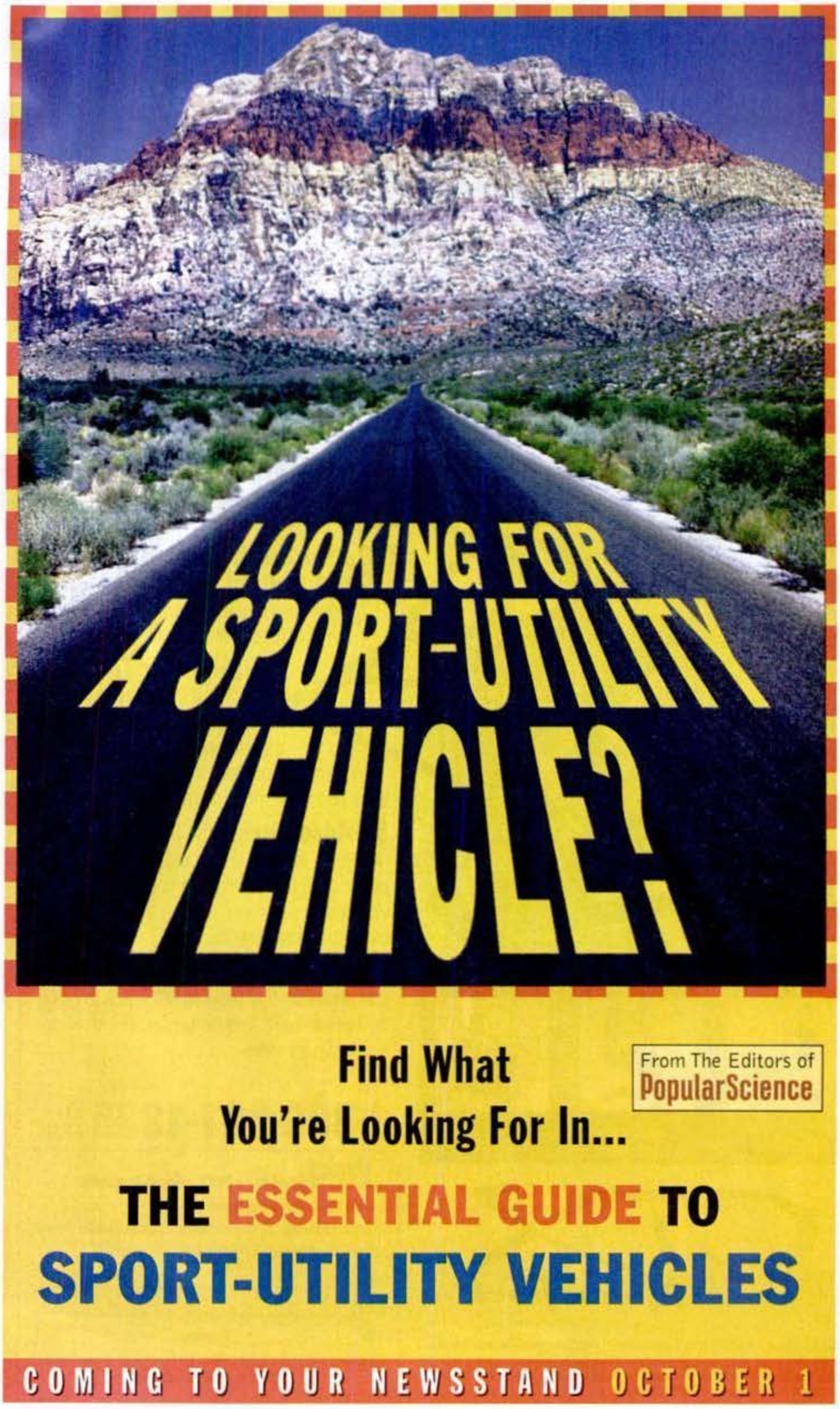
Imran Zaidi
New Brunswick, Canada

ACTUALLY, IT'S A liquid (water) that contains solid particles that are mixed but undissolved. These particles may include milk solids and bacteria cultures. Scientists call this sort of thing a "suspension."

Why can't we tickle ourselves?

Scott Moskowitz
Agoura Hills, Calif.

BELIEVE IT OR NOT, there is actually a book called "Why Can't You Tickle Yourself, and Other Bodily Curiosities," by science writer Ingrid Johnson. She writes that there are two types of tickling: gentle and aggressive. Gentle tickling involves a light touch to the skin and is most effective where nerve endings are densely packed, like under your arms, for example. We have evolved to react to these light touches (a mosquito, or a snake sliding over our feet) with caution; the stimulus signals potential danger. When the danger proves harmless, we nervously laugh in relief.



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Then there is more aggressive tickling. This is perceived as a major threat, and again, when there is no actual harm, it creates tremendous relief, and we laugh hard. If this type of tickling continues, it actually starts to hurt.

In either case, tickling requires surprise. We haven't developed any mechanisms that alert us to danger in what we're doing to ourselves. According to University of Florida physiologist Ian Phillips, "At the same time that your brain is sending

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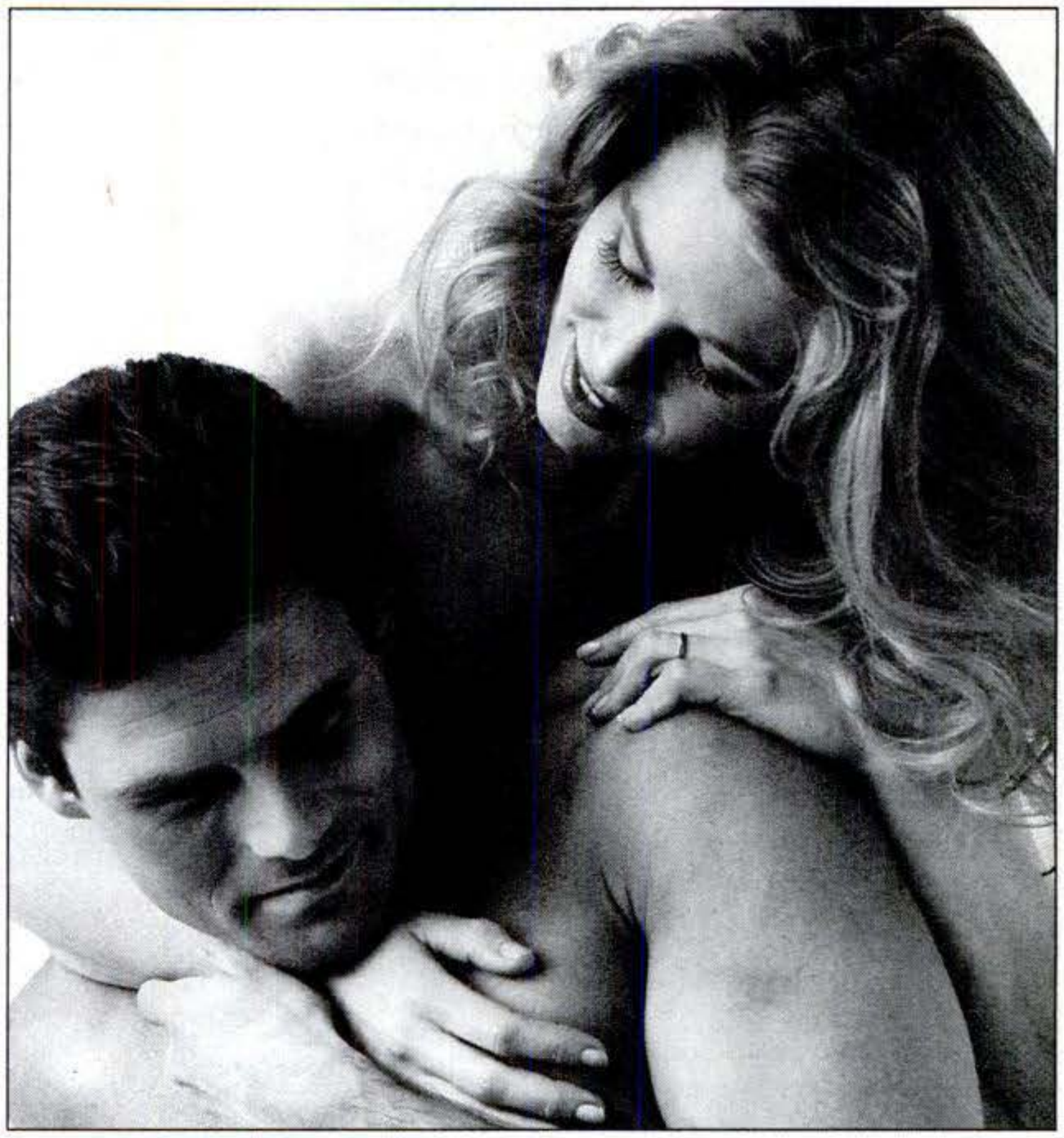

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ESSAY

The Next Energy Crisis?

BY AMORY AND HUNTER LOVINS

MARIA RENDON

IN THE 1980s, the Chinese government bought scores of cast-off Western refrigerator factories to boost the number of Beijing households with refrigerators from 6 to 60 percent. Unfortunately, the obsolete refrigerators guzzled electricity and used chlorofluorocarbons—chemicals now being phased out worldwide. Thus, a well-meant development effort wasted half a billion dollars on needless power plants, created shortages of power, degraded the ozone layer, and worsened climatic change.

Across the straits in Taiwan, back-alley shops today make unrefined scrap copper into impure, high-resistance wire for cheap motors, houses in Taipei, and fluorescent light fixtures.

On the surface, these products look like money savers. Actually, the substandard wire is crippling development: A 75-kilowatt motor made with it might appear to be $1,000 cheaper, but its inefficiency costs the national utility more than $30,000 for extra power plants and lines.

Inefficient refrigerators and motors are the tip of a vast iceberg on which Asian development threatens to founder. Today, herculean plant-building efforts can't keep up with burgeoning populations and wealth. Increased demand for air conditioning alone probably adds 20,000 to 25,000 megawatts to the Asian region's peak load every year—equivalent to half the peak load of all of New England and New York state combined.

In many developing Asian countries, brownouts or blackouts are frequent, often bringing factories to a standstill. Whole national economies balance on the knife-edge of the next boiler tube or turbine bearing to fail. Governments issue futile appeals for citizens not

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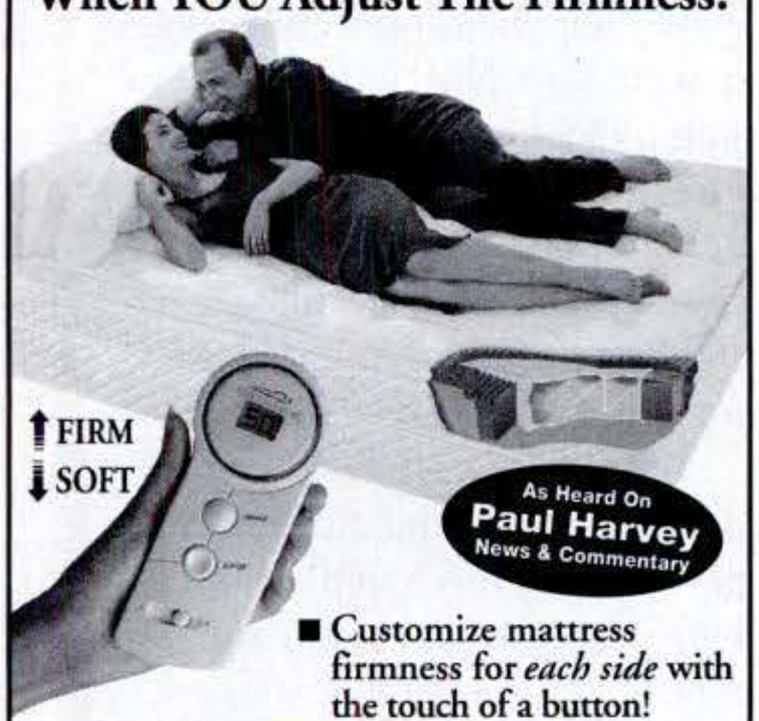

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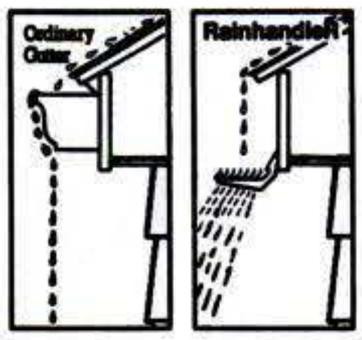

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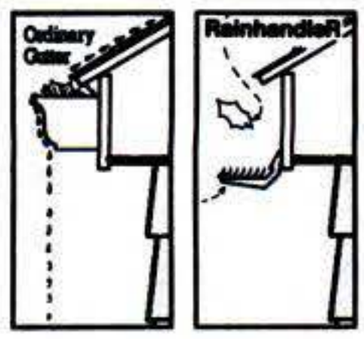

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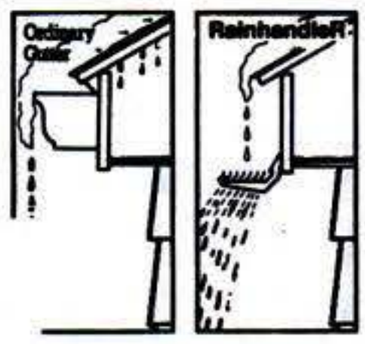

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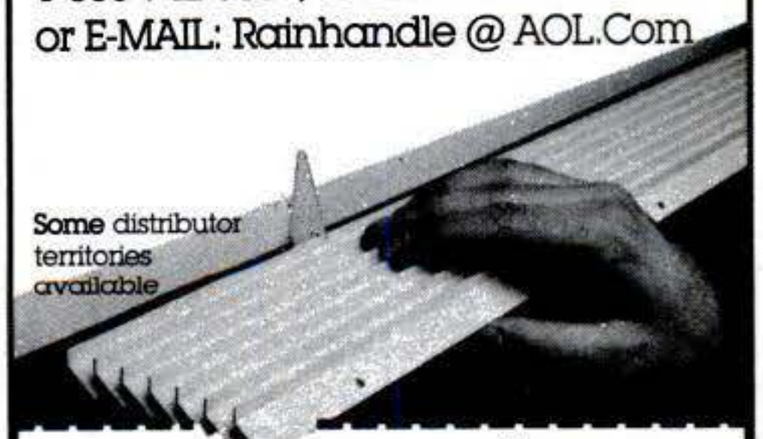

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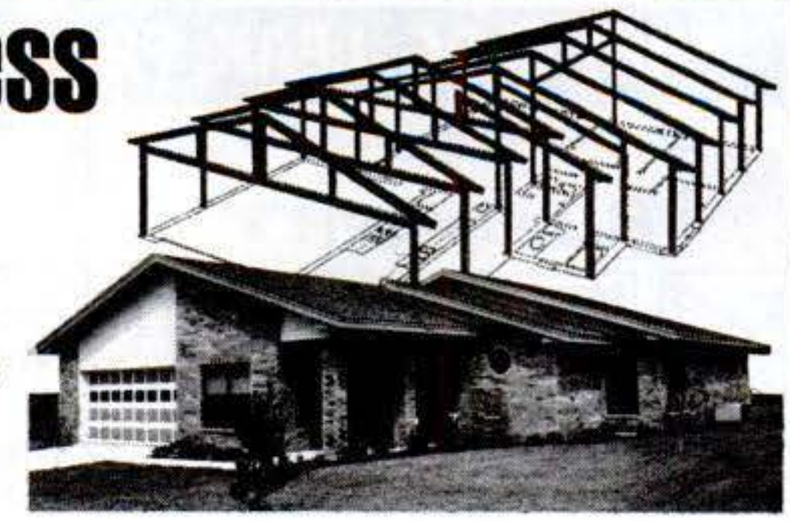

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to use air conditioners or elevators, because they know of no other way to balance supply with demand. But many Asian utilities undermine those appeals with promotional rate cuts for the biggest guzzlers of electricity.

Such inefficient use bears a crippling cost. Financiers project that developing countries will need almost $70 billion in power-related investments each year between 1996 and 2000—about a quarter of their total capital—and twice as much thereafter. That's money that cannot be spent for such basic needs as clean water, infant immunizations, and female literacy.

But there's another way: Use less electricity more efficiently. It is now far less expensive to save most electricity than it is to produce it. In Bombay, for example, building an $8 million factory to make quadrupled-efficiency compact-fluorescent lamps could save India 3,700 megawatts of capacity. Compare that to the $9.4 billion it costs to build more power plants to supply that much power. In Bangkok, a $10 million "superwindow" factory could make enough heat-rejecting windows to save Thailand 3,000 megawatts, avoiding $7 billion in utility investments. Moreover, such lamp or window factories pay for themselves in a few years, while power-station investments are tied up for decades.

Efficient use also saves money on a building-by-building scale. Superwindows, for example, make buildings cost less to construct—not merely to run—because they require far less air-conditioning equipment. Pacific Gas & Electric (PG&E) has demonstrated that many old and new buildings could save around 75 percent in electric costs by boosting efficiency, and improve comfort at the same time. Overall, Asia's potential savings from efficiency are even bigger than in North America, where Southern California Edison in the mid-1980s

was reducing projected electric loads at a rate of more than 8 percent per year—at 1 percent the cost of building new power plants.

Yet little of that potential is being captured in Asia: Efficient use gets perhaps 1 percent of the $2 billion the World Bank invests each year in power for developing countries. Why? Although Asian utilities seek the cheapest power and say they want to use it efficiently, they have no principle for allocating capital between those two objectives.

By contrast, almost all North American utilities follow—or at least claim to follow—the Federally mandated "least-cost" principle: They satisfy their customers' service needs in the least expensive way possible. Some states reward this sensible course by decoupling the utilities' profits from their sales (so they're no longer rewarded for selling more electricity nor penalized for selling less) and letting them keep part of the savings as extra profit. As a result, three-quarters of PG&E's new power in the 1990s will come from more-efficient use by customers—so-called "negawatts." Around 1980, the utility was planning to build another 10 to 20 power plants. Now it plans none, and its customers are billions richer. By rewarding utilities for cutting bills, not selling more energy, Asia could do even better.

Ironically, some developing countries already make very efficient equipment...for export. All the efficient refrigerator compressors made in Brazil and 95 percent of the compact-fluorescent lamps made in Mexico are exported. A Singaporean engineer designs the world's most-efficient big air-conditioning systems, but mostly for foreign buyers.

Until Asian governments realign the mission of their utilities to meeting customers' needs at least cost—mainly with energy efficiency but increasingly with renewable energy—most of their capital and talent will stay misdirected. Worse, Asia's development will be stunted, its opportunities wasted, and its electricity scarce. Unlike America, though, Asia has an opportunity to do it right the first time. ◆

Amory and Hunter Lovins are, respectively, director of research and president of Rocky Mountain Institute (http://solstice.crest.org/rmi), *a nonprofit center in Snowmass, Colorado, devoted to the efficient and sustainable use of resources.*

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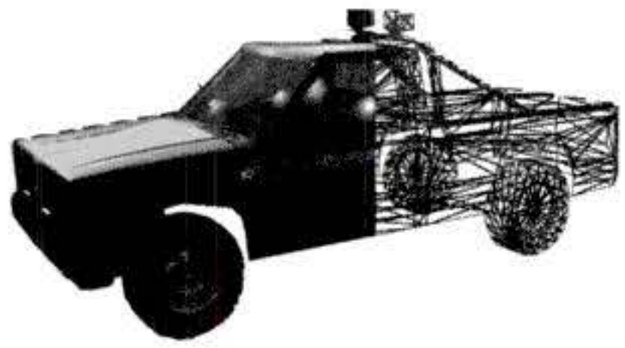

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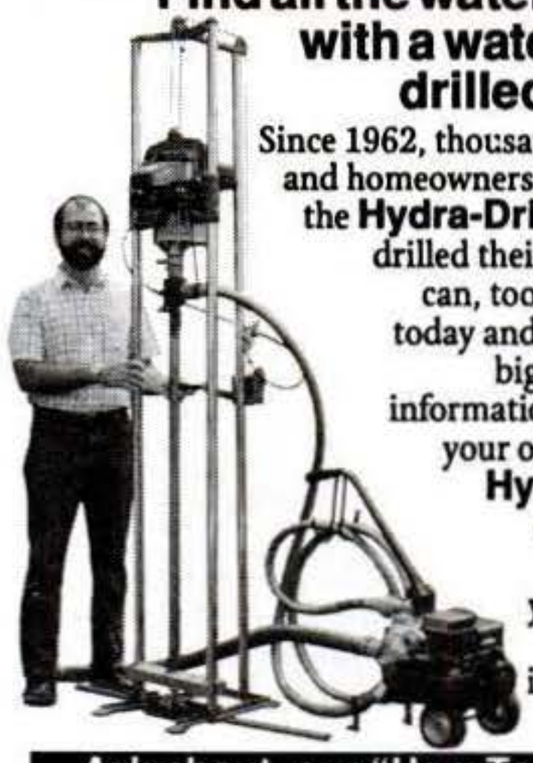

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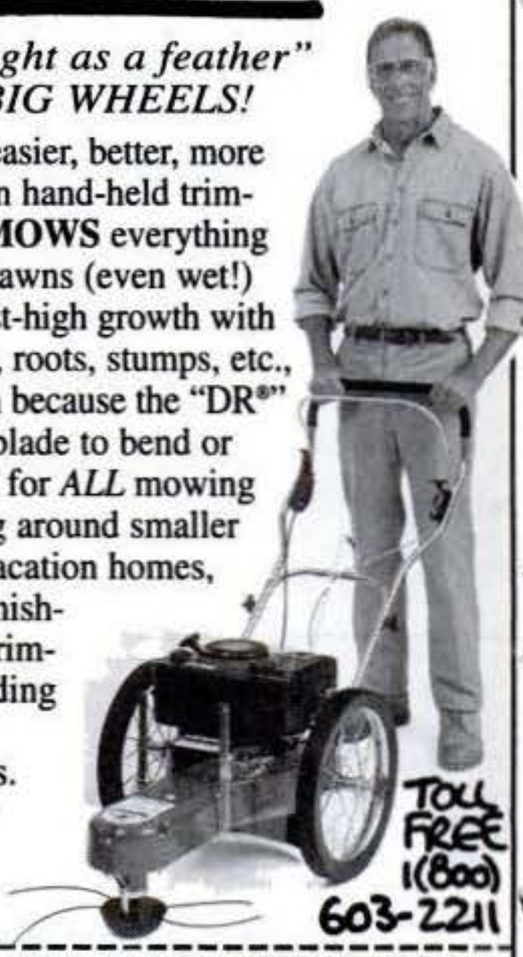

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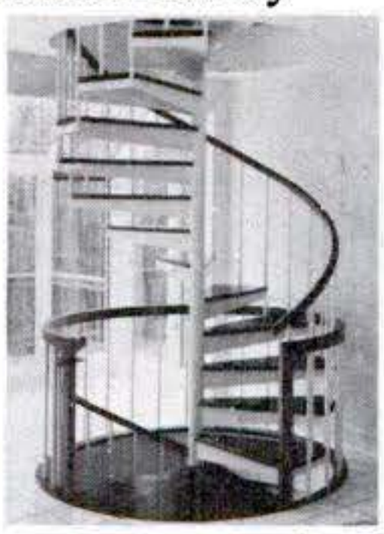

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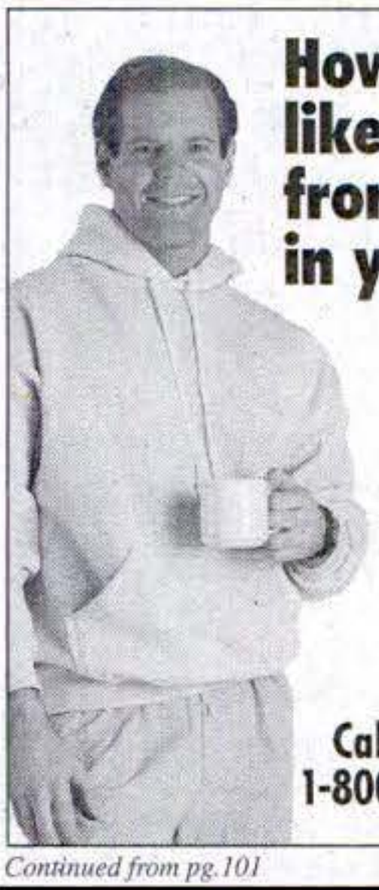

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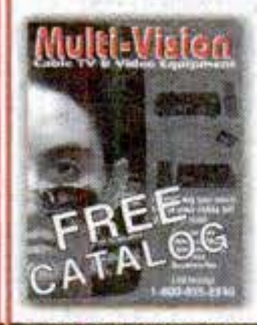

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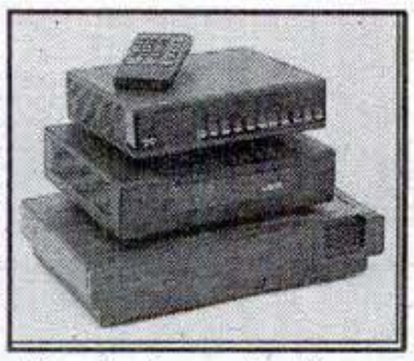

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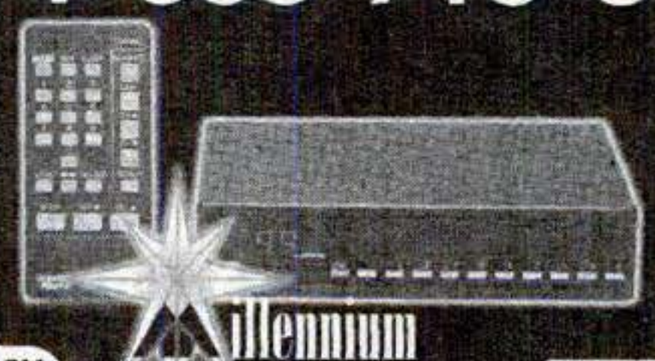

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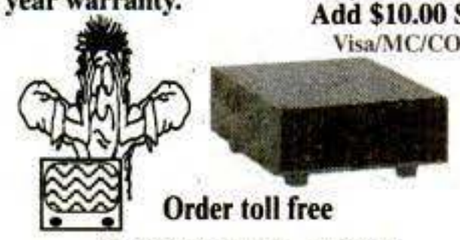

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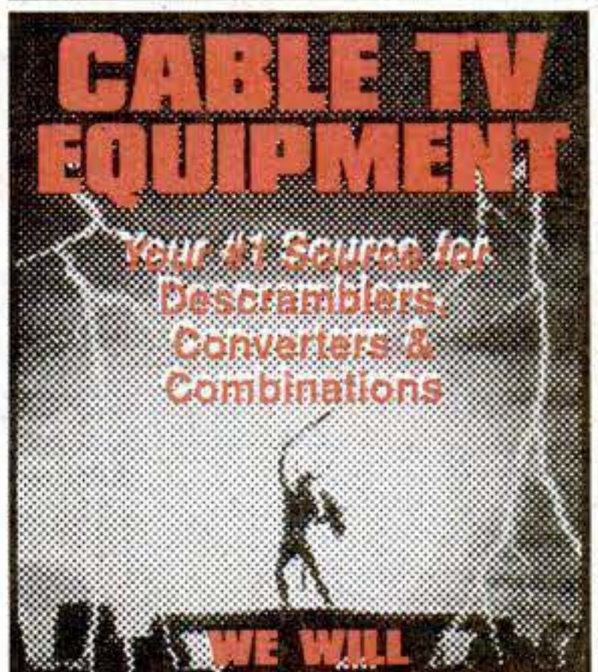

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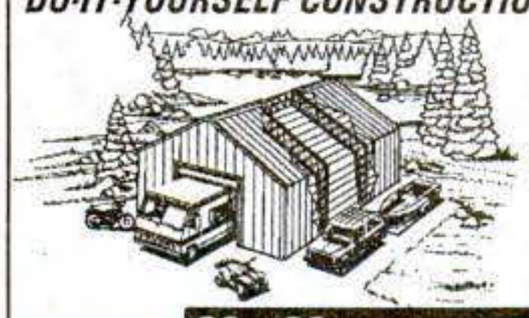

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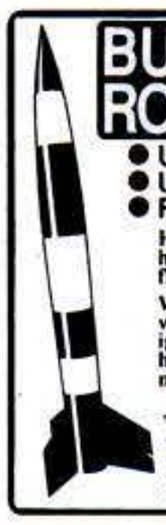

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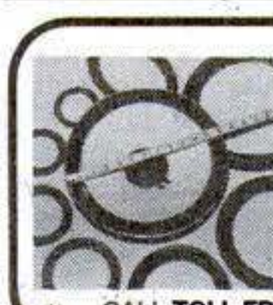

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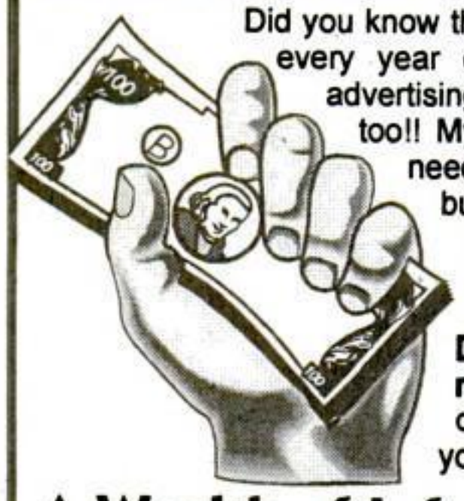

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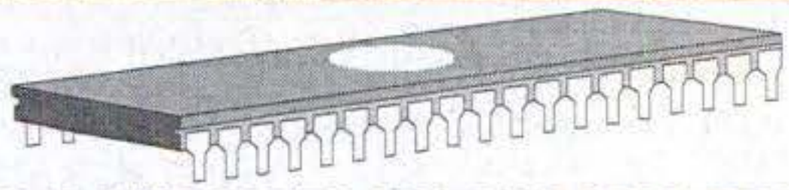

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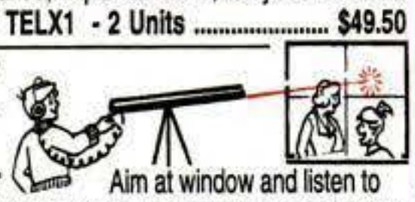

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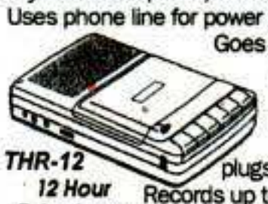

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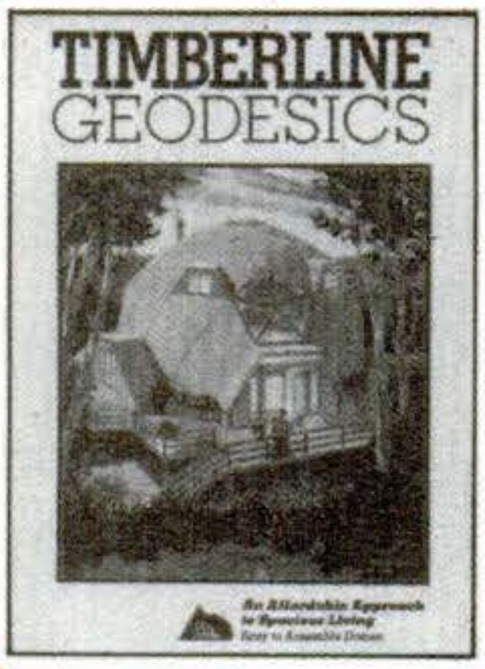

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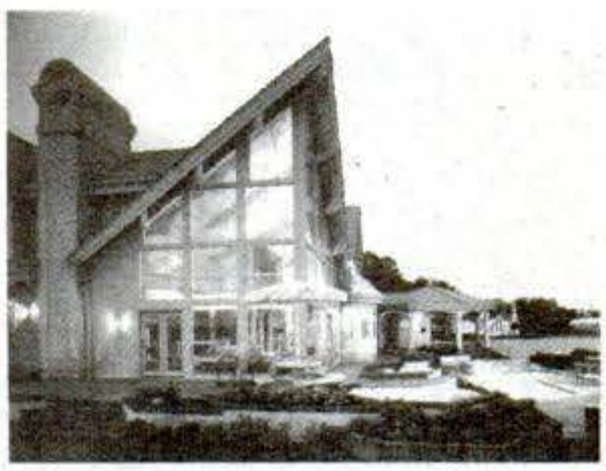

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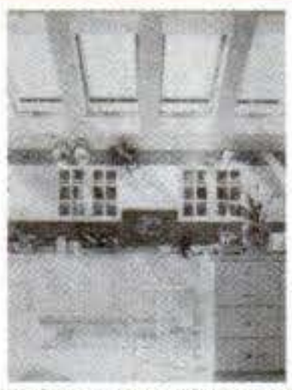

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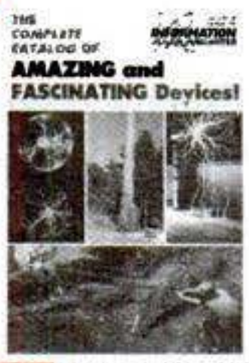

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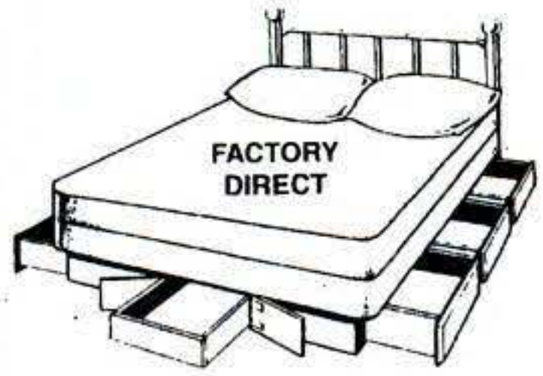

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Explorer 42 is credited with discovering a black hole in the constellation Cygnus. Today, astronomers using the orbiting Hubble Space Telescope have been able to confirm the presence of super-massive black holes.

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Huge Pool at Madison Square Garden

75 YEARS AGO THE INTERIOR of Madison Square Garden has been turned into one of the largest swimming pools in the world. The pool is 110 feet wide by 150 feet long and holds 1,500,000 gallons of water. Miniature waterfalls beautify the pool at one end. —*September 1921*

The pool was built during the Garden's second incarnation at Madison Square between 26th and 27th streets. Garden officials report that the idea of using the facility as a pool was abandoned after the summer of 1921. In 1925, the Garden moved uptown to 50th Street; the modern Garden opened at 33rd Street in 1968.

Pilgrims to Cozumel

100 YEARS AGO ABOUT 10 MILES from the east coast of Yucatan is the lovely island of Cozumel, almost uninhabited now. When the Spaniards arrived 365 years ago, it had 100,000 inhabitants, plus 50,000 pilgrims annually. This "place of swallows" (*cuzamil*) is an interesting spot for antiquarians. In its dense forests are curious old buildings, and beneath the ground may be found specimens of ceramic art.—*September 1896*

Once a shrine to the Mayan goddess of fertility, Cozumel now has about 45,000 yearlong residents. Some 1.5 million pilgrims of a different sort also flock to the island yearly to enjoy its sun, and stunning coral reefs.

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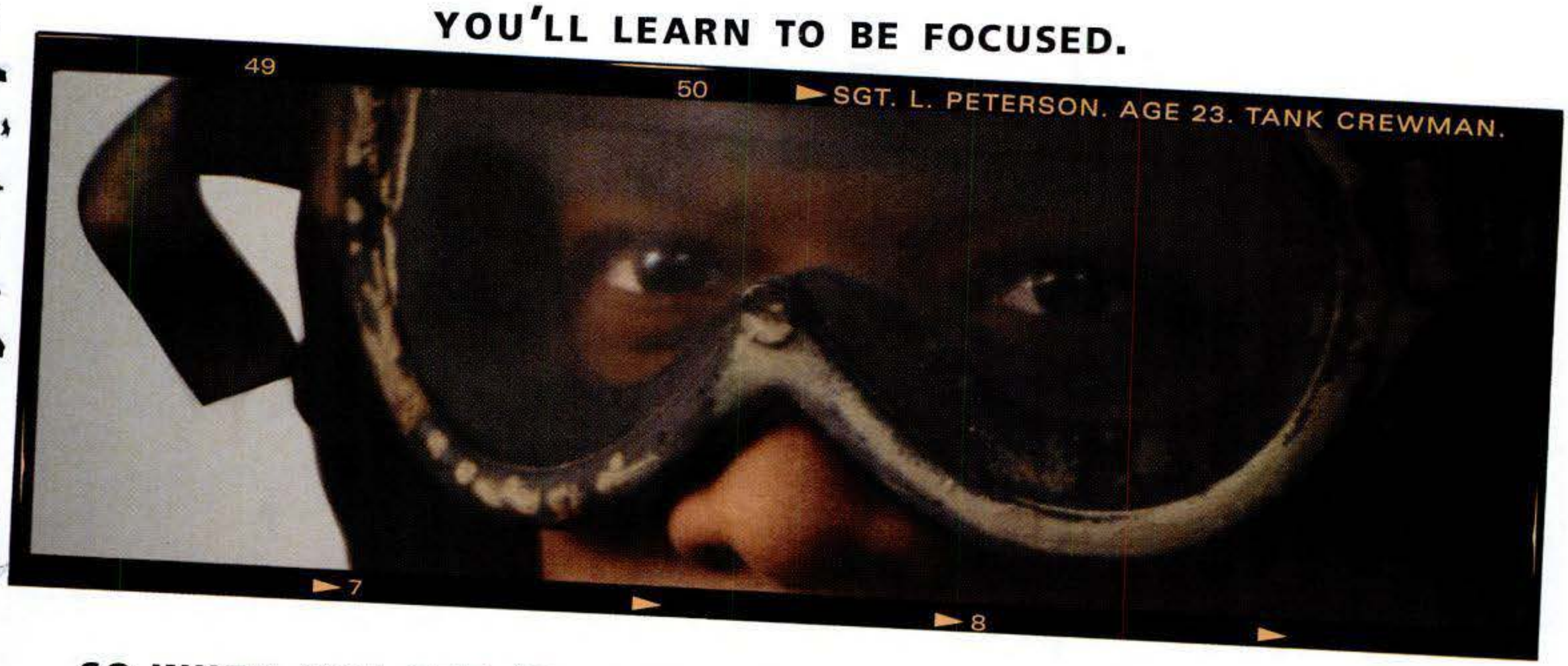

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After the kind of day you put in, all you want to do is fall into your favorite easy chair and put your feet up. That's why we designed the inside of the Chevy Full-Size Extended-Cab to be so comfortable. Kick back in the form-fitting seats with their available leather surfaces. Or choose power bucket seats that'll let you adjust to your favorite position with the touch of a finger and a center console that's about as versatile as the Original Swiss Army™ knife. So relax. You can still call on the Chevy C/K Pickup to be tough and dependable. But maybe now you'll also want to call it home.

Chevy Trucks
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